Vol. 19. No. 12 DECEMBER, 1921

THE METAL INDUSTRY

WITH WHICH ARE INCORPORATED
THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER
ELECTRO-PLATERS REVIEW

Entered as second class matter February 10, 1903, at the post-office at New York under the Act of 1879.

A MONTHLY PUBLICATION RELATING TO THE METAL AND PLATING TRADES

SUBSCRIPTION PRICE PER YEAR, UNITED STATES AND CANADA, ONE DOLLAR; OTHER COUNTRIES, TWO DOLLARS. THE METAL INDUSTRY PUBLISHING COMPANY, 99 JOHN STREET, NEW YORK

THE METAL INDUSTRY
WITH WHICH ARE INCORPORATED
THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER:
ELECTRO-PLATERS REVIEW.

Vol. 19 NEW YORK, DECEMBER, 1921 No. 12

Some Problems in Non-Ferrous Metallurgy

A Review of a Few of the Difficulties in the Production of White and Red Metals in a Large Smelting Plant*

By Dr. J. H. RANSOM, James Milliken University, Decatur, Ill.

The peculiar and important qualities which could be imparted to the commercial forms of iron by proper heat treatment caused its physical metallurgy to become known at a much earlier date than that of a number of other metals whose discovery probably preceded that of iron. In fact, a study of the non-ferrous metals and their more common alloys is of comparatively recent date and has been inspired by, and has followed along the lines for the investigation of iron and its alloys. As was the case with iron the farther the investigation of the non-ferrous metals and their alloys proceeded the more numerous and important became the problems which presented themselves for investigation and solution. Some of these problems have dealt with the structure of the metals and alloys, of the possible allotropic varieties of the elements, the effect on properties and structure of varying the proportions of the alloyed components, the change in properties of small amounts of foreign materials, so-called impurities, the problem of the corrodability of metals and alloys, and possible methods of controlling corrosion under conditions of employment, the conductivity of metals and alloys towards heat and electricity as well as the effect of impurities on conductivity.

IMPURITIES AND THEIR EFFECTS

I have spoken of impurities in metals and alloys. Probably few, if any, commercial metals are 100 per cent. pure. The commercial alloys made from them are usually no more nearly pure. Besides, much of the alloyed material is now produced by re-melting scrap such as filings, borings, sweepings, buffings, etc. Such material is usually less pure than that made from the virgin metals because of necessary contamination during previous use; because of its introduction during re-fabrication; and also because the waste materials from alloys of different composition are carelessly allowed to become mixed in the factories where made. Thus aluminum bronze borings may and often do, become mixed with those of ordinary brasses and bronzes, thus introducing into the re-melt of the whole at least traces of aluminum which tends to increase as remelting is repeated and which finally may become detrimental for certain uses. This, as well as other impurities, can no doubt be removed, in great part at least, during the process of remelting and fluxing. But it is doubtful if, in the usual procedure, they are wholly eliminated, in which cases they remain and may seriously injure the quality of the alloy.

A probable case in point is the intercrystalline brittleness of lead. Even in a sample of high purity, when solidified from the molten state, it is almost certain that the impurity would collect in the liquid as the crystals form, just as the salt in water remains in the water as the ice forms. And just as in the case of the salt water the concentration of the impurity in the liquid part will rapidly increase as the crystallization proceeds and, finally, must separate at the boundary of the crystal grains with the last crystals which form. Thus would result an intercrystalline—or intergranular—layer very different in composition, and therefore in properties, from that of the granules and would result in a very decided change in some of the properties as compared with those of the pure metal. For example, the cohesion between the crystal grains might be greatly modified resulting in a change in tensible strength, elongation, and elastic limit. Besides, under corroding conditions the intercrystalline layer might be more soluble than the main mass of the metal and thus a weakening effect result in the presence of water or salt solutions. There might be, and probably would be, developed a difference in potential between the intercrystalline and intracrystalline material, in which case there would be a greatly accelerated dissolving of the more positive part with a correspondingly rapid change in the quality of the metal, and of its time of service.

Recently there has been described an alloy of copper and nickel, containing about 15 per cent. of the latter, which at times is said to develop intercrystalline brittleness, the reason for which is said to be hard to explain. If it can be demonstrated, however, that impurities are present, or if it is reasonable to assume their presence, though in too small amounts to demonstrate, then the explanation of the facts is

*From a paper presented before the American Institute of Chemical Engineers, Detroit, June 22, 1921. This paper was not reprinted and has not been published before, to our knowledge.—Ed.

as easy as in the case of lead, and may even be considered a necessary consequence.

At first it might be thought that the segregation mentioned above would occur only in case the impurity were soluble in the molten metal, but became insoluble at the moment of crystallization. No doubt such conditions would result in the most rapid and complete segregation. But there is some evidence, apparently, that changes may take place in solid solution or, at least, in very thoroughly distributed solid mixtures. It seems to have been shown that ferrite in steel diffuses from one place to another, under certain conditions, and collects at or near boundary surfaces. The explanation given involves the changing solubility of the ferrite under slightly changing conditions. If this is, indeed, established for ferrite, it is possible for other metals in solid solution or in intimate mixtures to behave in a similar way with like results.

It would be interesting and perhaps instructive to study polished specimens, both etched and unetched, of a series of alloys by means of photomicrographs taken periodically, at intervals of several weeks, for some years. By photographing the same spot repeatedly any segregations or other changes would be brought to light. The difficulties in doing this would lie in attempting to preserve the surfaces of the specimens for so long a time unaffected by the gases of the atmosphere. It might be done by keeping the specimens, between examinations, in sealed and vacuous tubes. Possibly such work has been attempted, but, if so, my attention has not been called to it.

EFFECT OF IMPURITIES IN SECONDARY METALS

It is common observation in foundry practice that occasionally castings or ingots made from metals, usually secondary, supposed to be of standard purity, are covered or spotted over with colors quite different from those usually associated with the alloy. From the commercial standpoint these colors are undesirable since they immediately place the metal under suspicion as being made from inferior materials; and slight defects, which otherwise would not be noticed or would be overlooked, are laid at the door of the colors even to the point of rejection of the metal. To throw light on the causes of these colors and to observe any alteration in properties accompanying the colors two series of experiments were planned and executed.

The first series was of a preliminary nature and consisted in studying the effect of a few of the most common impurities on twenty melts of from twenty to twenty-five pounds each of a brass, copper 80, tin 10, zinc 10. The second series was more extended, involving seventy melts of copper 85, tin, lead and zinc each 5, and the use of a half dozen or more impurities. The effect was found for each impurity alone, then for every possible pair and, finally, for every possible combination of three or more (except two or three by oversight). Test-bars were made with which to determine the usual physical properties; a special kind of bar was designed with which to observe any segregation of impurities at sharp angles, and to judge somewhat of the toughness of the metals. Photographs of those melts containing one and two impurities were made, as well as analyses of all the melts. Surface colors were accurately described and preserved with properly mixed metallic paints. The total amount of impurity in the metal was practically always under one-half of one per cent., often considerably less. The amount of each impurity was often under one-tenth of a per cent., and sometimes as low as this when by itself. In a few cases varying amounts of one impurity were used in different melts in order to study its cumulative effect.

As a result of the work several interesting observations were made. Where a surface change is made by one element it is usually characteristic and easily recognized. Usually, also, the properties suffered by the addition of a single impurity but, in a few cases, these remained unchanged or were improved. In general a combination of two or more impurities produced more color change and greater defects in the properties than the same percentage of one impurity. In a few cases the properties in the presence of two impurities were better than for either impurity alone, and the color was as good as when no impurity was present. A combination of more than two impurities always gave poor properties. The non-metals were more injurious than the metals. In all cases the hardness, tensile strength, and per cent. elongation were decreased and the yield point increased. In the cases of aluminum and antimony the hardness was increased for small amounts and then decreased below that of the virgin alloy. For different impurities the same amount of change in properties does not result from the same percentage of impurity. This, however, is not always true for certain percentages of a few of the impurities used.

POSSIBLE METHOD OF OVERCOMING EFFECTS OF IMPURITIES

A number of lines of experiment are suggested by the results of the work, but these have not been undertaken. The fact that a second impurity sometimes neutralizes the poor effect of a single one is especially significant from the practical standpoint. Since it is so difficult to remove the last traces of an impurity from a metal or an alloy, and thus prevent segregation, as in the case of the intercrystalline brittleness of lead, it seems possible and reasonable that some second element might be added which would prevent the segregation by forming with the first impurity a solid solution of higher melting point than the matrix, or in some other way preventing the impurity from being forced to the granular surfaces. In other words there might be induced a tendency towards physical homogeneity.

STANDARDIZED WHITE METALS

At the present time there does not seem to be any very good standard for the composition of babbitts or bearing metals. Almost every large user of this class of alloys has his own formula, which he believes furnishes a superior product. An examination of the composition and miscrostructure of different commercial babbitts does not warrant the belief that there is great difference between them; but that the supposed difference is a question of handling the material, or that it depends on the personal equation. At present the manufacturers are accustomed to furnish the material asked for without reference to its quality, and usually, I imagine, of necessity, asking a larger price than would be required if material of proven standard quality could be furnished. What is needed is an investigation into the qualities of all possible babbitt materials, including their wearing and antifrictional qualities, and the practicability of their use. From the list could then be selected a very few which would meet all the requirements of practical use. Ed-

ucation of the buying and selling organizations would soon follow and a clear standardization result.

What has been said in regard to bearing metals applies, but to a smaller extent, perhaps, to solders, especially to those for aluminum. There are many of the latter on the market, some under patent control. Usually they have a zinc-tin or a zinc-tin-lead base. The difficulties found in soldering aluminum are, to some extent at least, due to the thin layer of closely adhering oxide which rapidly forms on the surface even when freshly cleaned, thus preventing the adhesion of the solder to the aluminum. Part of the problem, therefore, involves the discovery of a suitable flux. At the present time fluxes are not usually employed; but, instead, a thin layer of the solder is applied to the surfaces while these are being cleaned with a steel-wire brush. This is a rather slow process, and, I imagine, is not as effective in cleaning the surfaces as a proper flux would be. But the problem of the continued strength of the soldered joint, or the question of the "aging" of the solder, is also involved. Recently there was brought to me a soldered joint which had been made some time before. It looked to be sound and strong; but two light blows with a hammer caused a clean separation of the aluminum from the solder. Assurance was given me that at the time the joint was made it was especially strong. Yet similar solders have been in use for a year or more without, apparently, losing any part of their strength. The whole question of the structural changes occurring gradually in certain aluminum alloys, the conditions of the changes, and the methods of preventing them is interesting and important from a practical standpoint and should be more thoroughly understood.

REFINING OF SECONDARY METALS

The usual methods of purifying alloys, especially secondary or re-melted material, leave much to be desired. This is especially so with the white-metal alloys. The use of zinc chloride, sal ammoniac, sulphur and rosin, is expensive, disagreeable, because of the fumes, and is very slow. Preliminary work on other methods has been done with good prospect of success in the saving of time and money and in an improvement in the atmosphere in which the work is being done. No doubt the improvements can be extended and perfected.

However, gentlemen, you have come to a great automotive centre and these papers are supposed, somehow, to reflect the atmosphere of such a centre. While what I have already said may be as applicable to the automobile industry as to any other, there are certain metallurgical problems, which make a special appeal to three large and rapidly growing industries, which have much in common. I refer to the warship, the airplane, and the automobile industries.

FUTURE INVESTIGATIONS

About a year ago, largely as a result of war experiences, Sir George Goodwin of the Admiralty staff of the British Empire, gave an address before the British Institute of Metals Society in which he emphasized the need for the navy of lighter metal construction, without the sacrifice of other qualities. What was suggested for the naval industry is equally applicable to the airplane industry and, perhaps, to a slightly lesser extent, to the automotive industry.

In this address Sir Goodwin suggested or implied that the solution of this problem lay along two lines of investigation, for the solution of which the metallurgist, the engineer and the manufacturer might well unite. And since the non-ferrous metals and alloys are usually less rapidly corroded than the ferrous, and are better conductors of heat, which in condensers and engine-cooling devices is an important consideration, it seems reasonable that the solution of the problems suggested may lie in the use of the former.

The first line of investigation suggested was along that of the constancy of the properties of metals and alloys. By implication, at least, there was also suggested an improvement in these essential properties. The engineer knows only too well how difficult it is to guarantee that the properties of industrial iron, for example, are constant throughout any large piece of it. Also he knows of the difficulty of exactly duplicating parts from metal even of the same composition. Added to these is the difficulty of exactly duplicating the composition of metals and alloys. Upon this uncertainty, in part, is based the **Factor of Safety**, usually large, which determines the size of each element in the structure. The factor of safety is, in reality, a quantity of material added to the whole element in order to strengthen a possible weakest point and thus be able to sustain, without fear of failure, the maximum load that may be applied. It is evident that if the metal were of like quality throughout the excess metal would become, largely, an unnecessary load to be carried throughout the life of the machine. It is said that in order to bring the bicycle to a weight where it could be easily propelled by man, the factor of safety was made lower than in any other machine. To do this the tubing was made from the best stock and was carefully inspected for flaws.

In the last few years a considerable amount of work has been done in improving the strength and the constancy of properties of the bronzes, especially those containing aluminum together with small amounts of other alloying elements. Very encouraging results have been secured; but the field has by no means been exhausted. A more thorough study of the effect of varying the proportions of the elements now being used, and of the less common elements not already tried, may reveal a combination of properties well suited to meet the critical specifications demanded of the three types of machines mentioned above, and these properties may be so constant that the factor of safety may be appreciably decreased without danger of failure. Any decrease in this factor will result in an almost proportional increase in the working radius of the machine for a given power input, and thus relatively a saving in fuel.

Another way in which lightness of construction can be accomplished is in the use of metals lighter than steel or the bronzes. From the standpoint of specific gravity the industrial elements fall into two groups, viz., those having a gravity between seven and nine, and those between one and one-half and three. In the latter class there are but two metals, aluminum and magnesium. Since the specific gravities of alloys are, approximately, the mean of their components, it follows that alloys having a specific gravity much less than seven can be made only by the use of considerable percentages of either aluminum or magnesium, or of both. Within the last few years, and largely as a result of the needs of the three types of machines already mentioned, a large amount of investigation has been carried on to the end that light alloys may be prepared having physical properties comparable with steel or the metals of the bronze and brass type. The work has not been without its successes,

and a number of light alloys are now known which, for some purposes, can replace the heavier and more usual metals and alloys. You all know of the light Dow metal alloy which is supposed to be able to replace the more usual steel in making pistons for automobiles; of the Duralumins which can be hardened much like steel, which resist corrosion fairly well, and which have other desirable physical properties. There are alloys of aluminum and tungsten which resist oxidation better than those of aluminum and copper, and these are now used to some extent in automobile parts. Alloys of alumnium, copper and tungsten are now used in making propeller blades for ships. Still there are an innumerable number of other combinations that have not been tried out thoroughly and work along this branch is only in its infancy.

There is some justification, apparently, for the belief that the best alloy is still in the future. In addition to the usual properties associated with high-grade metals the new metal, when discovered, must possess two qualities which are lacking in some of those more recently prepared. In service they must retain their properties through long periods of time, and must also retain them when subjected to the widely changing temperatures demanded in service. The investigation of the last property has scarcely begun, even for the more common metals, and the field is large for any one who wishes to enter it.

Estimating Weights of Castings from Patterns

Unreliability of Published Data

Written for The Metal Industry by WILLIAM H. PARRY

Why do the authors or compilers of technical books persist in embodying in their works, tables that, to say the least, are very unreliable. Take, for instance, the tables from which are supplied figures to estimate the weight of castings, non-ferrous and ferrous, from the weight of wood patterns made of pine and mahogany, to say nothing of the other woods mentioned, most of them unfit to use on pattern work of the cheapest type.

The makers of these tables must base their calculations on the assumption that one cubic inch or foot of white pine or mahogany will weigh about the same as any other of the same kind of wood, when, as a matter of fact, nothing could be further from the truth as a study of woods will reveal.

First let us take half a dozen planks from any carload of pattern pine, be it of the "uppers," "selects" or "fine common" quality, two inches in thickness by a foot in width, and ten feet long, and weigh each one carefully. The result will be surprising in that no two will weigh alike, and some one plank will be from one and a half to twice the weight of the lightest.

This puts the skids under the reliability of these tables right off the bat, but we will grease the skids with more reliable data, so that no dependence whatever will be placed on them by the readers of this article.

Let us assume that a one-inch plank of pattern pine has been dressed on both sides, and is of a fairly even thickness throughout. From this plank cut several blocks four inches square, being careful that they *are* four inches square, weigh them on a sensitive scale and note the variations, which in some planks will reach 100 per cent.

It is a perfectly safe statement to make that no material is so variable as wood. It cannot very well be otherwise, when we consider the conditions under which it grows, being subject to the whims of winds, rains, storms, fire, and soil condition that may be favorable and again may not be. There is a variation between air and kiln-dried lumber that precludes the possibility of any dependence being placed on its reliability as a unit of weight, assuming that both have been thoroughly cured by these processes. As many concerns are in a hurry to make their pile these days, it follows that many carloads of pattern lumber are sold under the guarantee of being "bone dry," which is a term used in the lumber trade to denote the last word in thoroughly air-dried stock. From past experience, however, this term does not always imply that **all** the lumber is **dry,** which is still another argument against the estimate tables. Any material that varies in weight as much as lumber cannot be used on a weight basis for other reasons that enter into its making, such as "quarter-sawed stock" that will crop up occasionally in a load or two of pattern stock. This is the ideal stock for patterns, as the year rings are exposed equally on both sides of a plank, from sapwood to heart wood, and would, if used exclusively for patterns whose weight must be as the tables have it, be the only stock that would average properly, but, this stock is not easily procurable to the exclusion of the rest of the sawlog, and when it is, the cost is prohibitive.

Getting the weight of a casting from a pattern is better accomplished through submerging it in water to get the volume, and even this method has its faults if the casting is to be a cored one, as the volume of the core must be subtracted from the whole, and as cores have a habit of being anything but easy to figure, the result is seldom satisfactory.

Some mechanical engineers are pretty good at figuring the weights of castings, and some are pretty rotten at the game of estimating weights from blue prints. An instance of this kind occurred about twenty years ago, at a works devoted to the manufacture of internal combustion engines as a side line, and located in Brooklyn, N. Y. The casting to be was a two-cylinder "block," eighteen-inch bores, water jacketed all around and from top to bottom, and with metal thicknesses so liberal as to be ridiculous in the light of present-day practice. The engineers had spent a lot of time figuring out the weight of this cylinder block, and had placed their calculated weight on the blue print.

During the making of the pattern it was made very evident to the boss pattern-maker that the calculated weight was considerably shy of what the scales would show. This brought about a discussion which was not settled until the casting was delivered with a memorandum bill embellished with the figures 4,500 pounds @—which was in excess of the pattern-maker's guess by 500, and the engineer's calculation by 2,500 pounds.

It is but fair to state that the best guesser of all concerned was the foreman of the local iron foundry where the casting was made. His figures were expressed in well-throttled Scotch-English to the tune of "somewheer 'twixt foorty an' faftae hunder."

Electric Silver Melting

Silver Melting in the Electric Furnace Eliminates High Crucible Cost and the Necessity of an Experienced Melter, Which Are Essential to Gas or Oil Fired Crucible Practice. An Electric Silver Melting Equipment Is Described and Cost of Casting Rolling Mill Silver[1]

By H. A. DeFRIES, Consulting Engineer, New York City

Silver is recovered mainly from auriferous silver bullion called doré, by electrolytic separation. It is then melted and fined in a furnace to be at least 997 pure and cast into ingots, in which form it is commercially known as bar silver.

Silver melts at 962 degrees C. (1,764 degrees F.). It volatilizes at high temperature, giving off a green vapor. In the molten state it has the property of absorbing 22 times its volume of oxygen, which is given off on cooling, causing the so-called "spitting" of silver. This, however, happens only with the pure metal. Small quantities of copper or zinc entirely prevent it as does also an inert cover. Arsenic, antimony, bismuth, tin and lead render silver brittle.

Besides the bar silver, the silver most commonly used is sterling silver, which is of 925 fineness.

Bar and sterling silver have been melted mainly in crucibles, either gas or oil fired, and charcoal is always used for a cover.

The danger with these methods of heating is that the silver becomes contaminated by the sulphur in the fuel. It is a well-known fact in such operation a marked difference will appear in the metal when using oils of varying analysis and even a change in the barometric condition of the air will be immediately noticeable in the crucible.

The cost of crucible renewals is heavy and should a crucible break the silver, which runs into the pit and has to be dug out, cannot be used again without previous refining.

For these reasons it is obvious that the crucible melting of silver is expensive and only the most skilled melter is assured of reasonable success.

The electric furnace, on the other hand, being free from these objections, possesses, therefore, great advantages over the crucible. I will give herewith my experience in melting fine and sterling silver by the electric furnace method.

To begin with, we have to make a distinction between melting silver first into bars for subsequent remelting; second into skillets for rolling or into castings.

I. BAR SILVER

As stated, the melting point of silver is 962 degrees C. (1,764 degrees F.), and a pouring temperature of about 1,038 to 1,093 degrees C. (1,900 to 2,000 degrees F.) has been found sufficient to cast silver into bars. This process is carried out as follows:

Silver is charged into a furnace preheated to about 1,038 degrees C. (1,900 degrees F.) and when molten it is covered with charcoal. The metal is gradually heated up to about 1,205 degrees C. (2,200 degrees F.) and poured at about 1,093 degrees C. (2,000 degrees F.). Before pouring, a test is taken by dipping a rod into the bath. The sample on the end of the rod should show no spots on the surface and have a pure silver white color. The metal is poured either directly into moulds, or into a pot or crucible. The latter should always be thoroughly preheated and covered with charcoal.

When filling the moulds, which should have been warmed and smoked, a small stick is held in contact with the surface of the silver to collect any floating slag or impurities. As soon as the mould is full a small piece of paraffin is thrown on the metal. By this method smooth bars are obtained, but they cannot be used for rolling.

An excellent example of this practice are the runs at the U. S. mint in Philadelphia, where over 3,000,000 pounds of silver dollars were remelted into bars in a 1,000 lb. Rennerfelt electric furnace, with a metal loss of 1/100 of 1 per cent. or equal to 1 oz. in 10,000 oz. The power consumption for this work averaged 180 KWH per ton and the acid lining of this furnace outlasted the entire run.

II. MELTING ROLLING MILL SILVER AND CASTING SILVER

As previously stated, the pouring temperature for bar silver is about 1,093° C. (2,000° F.). If, one, however, would endeavor to pour silver at this temperature into rolling mill stock or into castings, the resulting materials would be so brittle as to be entirely worthless for subsequent working. Therefore, special methods have to be employed. These methods were recently worked out by the experiments the writer made at the plant of the Gorham Company. At this plant a specially designed electric furnace of 10,000 oz. capacity is in use and all runs and tests were made on an average of 4,000 oz.

What is said in the following will refer to fine silver as well as sterling, as I have found little difference in the behavior of the two metals. In general the following points should be strictly observed:

1. The proper temperature at which rolling mill and casting silver should be poured is 1,293 to 1,304°C. (2,360° to 2,380°F.), when cast into horizontal or nearly horizontal moulds and 1,204° C. (2,200° F.) when cast into vertical moulds.

In practice horizontal moulds are set on an incline of 5°. If the metal is poured at a higher or lower temperature than the one given, brittle ingots will result and the closest temperature control is, therefore essential.

2. Silver schould be prevented from absorbing its customary amount of oxygen from the beginning of the melt.

As previously intimated, an inert cover or the addition of small quantities of copper or zinc prevent this absorption. Large amounts of charcoal are objectionable in most operations, as it has to be removed before pouring. The use of copper and zinc is limited, as the silver must be kept within 1/1000 of the standard and even the smallest addition of copper and zinc will alter the assay standard more than is permissible.

We must, therefore, look for other means of overcoming these difficulties and same are easily found

[1] Presented as part of a Symposium on Non-ferrous Metallurgy at the Fortieth General Meeting of the American Electrochemical Society held at Lake Placid, in the Adirondacks, September 29-October 1, 1921.

by taking advantage of the melting conditions in the electric furnace. Every electric furnace can be made fairly airtight, thus making its atmosphere independent of outside conditions. The electrode furnaces generally supply enough carbon from their electrodes to create a slightly reducing atmosphere and by adding small amounts of powdered charcoal they can be made more strongly reducing. We thus have a medium of producing the proper atmosphere without having to resort to large amounts of reducing agents.

Having obtained the proper atmosphere in the furnace the silver must remain quiet; never be disturbed by rocking or stirring, as this would immediately bring unprotected silver in contact with any entering gas and thus disturb the equilibrium of the charge.

Good ductile silver can be produced by this method and the maximum amount of powdered charcoal to be added will not exceed 1 lb. per 5,000 oz. of silver.

It was the desire of the Gorham Co. to produce silver much more ductile and tougher than any produced so far in crucible. We resorted to the old English practice of putting a block of iron in the bath. The results then obtained exceeded all expectations, as is evidenced by the tests given later. The correct performance of this iron block I have not as yet been able to solve. The English melters claim "it gives the silver the heat," and they are correct in this assumption, as it certainly acts as a stabilizer towards the heat in the silver. I believe, however, that it performs a more important function. It seems that not all the oxygen occlusion is eliminated by the proper furnace atmosphere or the addition of copper, but that some oxygen is retained in the metal. The iron probably absorbs these remaining traces of oxygen or enough of it to produce a metal of the correct pitch.

My attention was called to the fact, that most iron metallurgists are wary about admitting the occlusion and absorption of oxygen by iron at such low temperature.

That oxidation of the iron takes place is evidenced by the fact that the block becomes pitted after being used various times and gradually diminishes in volume. This matter, therefore, warrants closer investigation.

3. The next important item is the handling of the metal from the furnace to the moulds.

The charge should not be poured through the furnace door, if this door has to be opened during pouring. It is much more convenient to pour the silver through a separate taphole, which can be lined and kept closed by a plug made from an electrode stump.

The travel of the metal from spout to mould should be as short as possible and all chilling should be prevented. With proper arrangement I have experienced no trouble due to chilling and skin forming during pouring and casting.

If an intermediate receptacle is used between spout and mould, same should have a cover and should be thoroughly preheated. Any metal left in this vessel should be poured out before taking the next charge from the furnace. All moulds should be smoked and warmed up to about 204° C. (400° F.).

A complete and efficient silver melting equipment is illustrated in Fig. 1 and its mode of operation is as follows:

"A" is a lip-tilting electric furnace, which is charged through furnace door "B." Before charging the furnace it should be preheated to about 1,093° C. (2,000° F.).

If necessary, enough powdered charcoal is added to give the right atmosphere. As soon as the silver begins to melt, the iron block is put in the bath and the metal is heated up to about 1,314° C. (2,400° F.), but not higher. If no pyrometer is available, tests are taken. These consist in pouring a spoonful of metal into water. The right temperature is indicated when the granules thus produced are round and do not hang together. If flat pieces appear the metal is too cold.

For sterling silver, the water is then poured off the test and the globules are annealed over the furnace door. If they show a bronze tarnish, the metal is right for pouring.

The furnace is then tilted and the metal discharged through the specially lined taphole and spout placed directly beneath the door.

The charging door remains closed and as the taphole is of small diameter, it is covered by metal during the pour and no air, therefore, gets into the furnace.

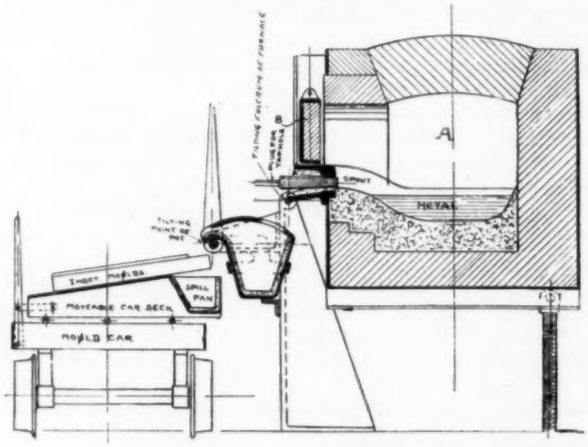


FIG. 1. COMPLETE SILVER MELTING EQUIPMENT

The metal flows from the spout into a lined pot or crucible hung in front of the furnace. It is provided with a cover and sets into a ring so that the entire pot is removable. Before using, it should be thoroughly preheated and it should be of sufficient capacity to hold enough metal to fill one or more moulds. The pot is also lip-tilting and is worked by a lever. In front of this pot runs a mould car provided with a deck, which can be moved back and forth. Under the pouring tops of the moulds is provided a spillpan, to collect all spillings and into same is also poured all surplus metal from the pot.

The operation of this device is very simple and no charcoal will be needed outside of the furnace.

The furnace lining can be either of silica brick or firebrick, with a hearth of gannister or carborundum. The hearth material should be wetted down with silicate of soda, tightly rammed in and thoroughly sintered. The life of such a lining will be almost indefinite.

As already stated, the furnace used by the writer was a modified 100 KVA Rennerfelt of 10,000 oz. capacity, with a total production of 60,000 oz. of silver per 8 hours.

The metal losses on the runs made were not quite conclusive, but averaged about 1 oz. per 1,000 oz. melted.

The furnace was newly lined and most of the losses must be attributed, therefore, to absorption. I am fully convinced that these losses will be cut in half and even down to one quarter after the furnace has been in use a little longer. The power consumption per

ton of silver averaged 330 KWH with preheating and 260 KWH without preheating. The average consumption per 1,000 oz., therefore, is about 12 KWH.

The cost of melting and casting 1,000 oz. of rolling mill silver were as follows:

Loss ½ oz. per 1000	$0.25
Power 12 KWH at 2 cents	0.24
Labor, melting and pouring	0.20
Charcoal at 2 cents per lb	0.0025
Electrodes	0.05
Refractories	0.02
Heating ladles and moulds	0.02
Total	$0.7725

If silver losses are reduced to 1/4 oz., the total cost then would be 65 cents.

The silver produced by these methods was thoroughly tested and compared with standard grade crucible silver and the results are given in a letter from the Gorham Company.

"June 21, 1921.

Mr. H. A. DeFries,
Consulting Engineer,
15 Park Row, New York City.

Dear Sir: Answering your letter of June 12th, in which you ask us for information concerning the results which we obtained from tests of silver made in the Rennerfelt electric furnace.

Will advise that in the drawing operations, which furnished a very severe test for the silver, it proved much more satisfactory than the silver produced by the crucible method of melting.

The spinning, stamping and hammering tests also showed it to be more ductile and more easily handled than our regular stock, as it seemed to have a much finer grain and would stand more punishment than the silver melted in the crucible furnaces.

As to the tensile strength, would say that while it showed favorably, it was not a test that we would care to say much about, as the test was made under very unfavorable conditions from a drawn part which had been cut crosswise of the grain of the stock from which the specimen was drawn, and I don't think this test would be fair in either case.

Yours very truly,
(Signed) G. H. NORTH,
Superintendent."

An extreme test for deep stamping and forging was made at the same time on seven sheets of crucible silver and seven sheets of electric silver, with the result that six sheets of the crucible silver were destroyed, whereas the electric silver came out 100 per cent. perfect. A spinning test on the same number of sheets showed that all crucible silver failed, before any splitting or warping of the electric silver took place.

The last question to be considered is the elimination of impurities which may get into the silver, especially if old metal and scrap are remelted. These impurities consist mainly of small particles of German silver, but seldom more than a fraction of 1 per cent. The zinc from these impurities can be eliminated by distillation. The surplus of copper can be compensated by adding sufficient fine silver to get the right assay standard. Nickel, however, cannot be removed, but will be present in such minute quantities that it will not affect the standard in a detrimental way.

Most silver melting plants possess a complete refining equipment and generally the melting furnace is not called upon to do much of this work.

Lead Plating

Q.—1. What is a practical formula for a still and barrel lead plating solution?

2. What means are there for keeping the natural lead color and eliminate the white chalky coating found in lead plating?

3. What purity of white lead and boracic acid are necessary?

4. What current density and voltage should be used?

A.—The most practical lead solution is the fluorsilicate lead solution. You can purchase this type of solution from the lead refiners. It is a by-product in the refining of lead and makes a very effective solution.

Several of the large storage battery firms use this type of solution. It should be used undiluted at 2 to 3 volts for still solutions and 6 volts for mechanical solutions at 5 to 10 amperes. The addition of 4 ozs. upwards of boracic acid per gallon of solution improves it. A slight agitation of the solution prevents the occlusion of hydrogen, which frequently causes minute blisters in the deposit.

Steel parts should be thinly coated with a deposit of copper deposited from a copper cyanide solution for the most effective results, if the fluorsilicate or fluorborate solution is used.

Some platers use the hot caustic soda-lead acetate solution to give a basic deposit of lead previous to plating in either type of acid lead solutions.

The following formula is used:

Water	1 gallon
Caustic Soda 76%	27 ozs.
Lead Acetate Crystallized	9½ "
Gum Arabic	½ "

Temperature 180 to 200 degrees Fahr. at 2 to 5 volts.

No. 2. Lead properly deposited and carefully washed and dried should not show films of lead carbonate. A very thin coating of oil or a mixture of paraffine oil or paraffine wax, heated to 200 or 212 degrees Fahr., wherein the lead plated articles are immersed for a moment will prevent the action of damp atmosphere forming the film of lead carbonate upon such articles.

No. 3. Commercial lead carbonate is satisfactory for lead solutions. This also applies to boracic acid. The latter if in a crystal form dissolves more readily in boiling water.—C. H. PROCTOR.

White Metal Molds

Q.—I would like information on how to cast white metal molds over a fancy carved wooden pattern, so mold would come out nice and smooth.

The mold, after being made is going to be used for pressing of plaster of paris or clay compound for fancy ornaments.—W. J. Reardon.

A.—We do not know of anything you could put on a wooden pattern so as to cast a white metal over the wood, so that it would come out nice and smooth. The cheapest and best method would be to cast a mold of plaster of paris. This can be done by first making the partings required either in sand or a follow board, then oiling the pattern with lard oil and placing a wooden frame, the required thickness, around the pattern, and then pouring the plaster on the pattern. After the plaster is set, remove the pattern and coat the mold with a coat of shellac. You can so arrange the partings that the mold would open and close easily for your plaster of paris or clay compounds. Cast your plaster mold out of aluminum. If careful work is done in molding the first plaster mold, very little if any work will be required on the aluminum mold. An aluminum mold will be lighter to handle and much more serviceable.—W. J. Reardon.

The Electric Furnace Melting of Nickel Silver

The Author Presents Advantages of the Externally Heated Electric Furnace for Nickel-Silver Melting[2]

By F. C. THOMPSON, D.Met., B.Sc., Professor at Sheffield University, England

Of all types of electric furnace for the melting of steel, the arc is the one which has attained most success. In the melting of such alloys as cupro-nickel this success has also been attained within the realm of non-ferrous metallurgy. Such a furnace as the Héroult is eminently suited for this alloy, and purification and in particular decarbonization is an accomplished fact. Very large admixtures of scrap can be made to the charge and by an initial oxidizing stage under a slag consisting largely of oxides of nickel and copper, followed by a final deoxidizing one in which the first slag has been removed and for it one consisting of a little anthracite, limestone chippings and fluor spar substituted, exceedingly good material is produced.

When dealing with nickel-silver, however, this type of furnace ceases to be very useful as a result of the large volatilization of zinc around the electrodes. This results in high melting losses, a tendency, unless the chemical control is accurate, to irregularity of composition and an atmosphere in the melting shop which is far from satisfactory, although with an absolutely adequate system of ventilation this latter objection might be more or less overcome. The author's experience, which, however, has been somewhat limited on these lines, has not been satisfactory, and only where all the constituents of the melt are essentially non-volatile is the arc furnace, in his opinion, satisfactory. Certainly, however, where this condition is satisfied, this type of furnace is capable of yielding very promising results.

These facts lead to the conclusion that only electric furnaces of the induction type, or those in which the heating is by resistance in or around the walls, are of real utility. Experiments carried out in a small Kjellin induction furnace have not yielded results which possess much promise, so that resistance furnaces alone would appear to be satisfactory. These have already proved themselves efficient with melting of brass, and though the higher melting point of nickel-silver introduces a further difficulty there is, so far as the author knows, no inherent reason to doubt that nickel-silver can be satisfactorily melted in this type of furnace.

One may, therefore, conclude with a fair degree of certainty that the electric furnace melting of nickel-silver in a pure resistance furnace is a possibility. How far it may be commercially advisable to use this method is one of a purely economic character which will quite obviously depend on local conditions and no dogmatic opinion can be given.

(A) LOSS OF ZINC

The loss of zinc in crucible melting should not exceed somewhere about 1 per cent. In a closed electric furnace of the resistance type this figure should not be exceeded and may be substantially reduced.

(B) OCCLUSION OF GASES

How far gases, other than those which may introduce sulphur or oxygen into the melts, exert a harmful influence on nickel-silver is not known with any certainty, but to the author no such influence is known. One would be inclined, however, to expect that the lower the volume of occluded hydrogen, nitrogen, etc., the better. Where sulphurous gases are concerned it is emphatically the case that their influence in the metal is bad. All crucibles are permeable to gases in the melting holes and sulphur from the coke, etc., can be, and actually is, transmitted through the walls of the crucibles and absorbed by the metal. The electric furnace possesses here one of its greatest advantags since much of the deterioration of the metal even after repeated remeltings as scrap is reduced to a minimum.

Oxidation also certainly occurs in crucible melting even under the best conditions, although by suitable furnace regulation it may be minimized. The author has shown[3] that oxygen in nickel-silver occurs as minute globules of zinc oxide which probably increase the tendency for the metal to crack during annealing or stamping. Electric furnace melting should certainly lead to no great degree of oxidation, while under good conditions this may perhaps be reduced and with a suitable covering of an inactive slag the almost inevitable access of oxygen through charging doors, etc., should be prevented from entering the melt. The burning of a reducing gas in the furnace will also minimize this effect.

(C) CARBURIZATION

Nickel and the nickel alloys show a tendency to absorb carbon, in particular when molten, which is parallel to the tendency possessed by iron. The carbon, which normally occurs as Ni_3C exerts in that form very little, if any, harmful influence on the mechanical properties, and may even enhance these, yielding a metal which is both stronger and tougher. The conditions are, however, very different if the nickel carbide has decomposed with the precipitation of graphite, a tendency to which it is specially prone when annealed after cold work. This tendency is due to the exothermic nature of the decomposition of the carbide.

The author, in conjunction with Mr. W. R. Barclay[3] investigated this matter in the allied alloy cupro-nickel, and found that above about 700° C. graphitization occurs in highly carburized materials resulting in intense intercrystalline brittleness. In nickel-silver itself the author has shown that graphitization occurs preferentially at the surface of the specimen where the increase of volume associated with the change can be most readily accommodated.

The following figures taken from a paper by the author illustrate well the avidity with which the molten alloy will absorb carbon from the crucible and the deleterious effect of such absorption on the annealed material.

CRUCIBLE	ARNOLD ALTERNATING STRESS NO.
Black Lead	842
Clay	904

The increased "toughness" of the alloy (10 per cent nickel) melted under the less carbonizing conditions of the clay crucible will be evident. The latter conditions will correspond the more nearly to those in electric furnace melting.

In the author's opinion, therefore, where local conditions render it economically advisable the electric furnace of the external heating type possesses technical advantages especially where large quantities of scrap require to be remelted in (1) minimizing the accumulation of sulphur and carbon and thus (2) in reducing the amount of virgin metal required for the charge.

[1]Presented as part of a Symposium on Non-ferrous Metallurgy at the Fortieth General Meeting of the American Electrochemical Society, held at Lake Placid, in the Adirondacks, September 29-October 1, 1921.

[2]Trans. Chem. Soc., 1914, 105, 2342.

[3]Soc. Chem. Ind., 1919, XXXVIII, p. 1301.

The British Institute of Metals

Meeting in Birmingham (England)—Conclusion*

Written for The Metal Industry by Our British Correspondent

The Casting of Brass Ingots

This paper was presented by R. Genders, M. B. E. B. Met., A. I. C. Member (Woolwich).

ABSTRACT

The failure of hollow-drawn articles, made from 70/30 brass rod, by splitting an expansion during manufacture or in service has generally been found to be due to the presence of non-metallic inclusions which originated in the cast ingot. In articles drawn from cupped discs, punched from rolled strip, the inclusions in the walls are circumferential in direction and of less effect on the wall strength.

The methods used in casting ingots of brass vary considerably in detail. Much consideration is given to the saving of rolling, and ingots are made in a correspondingly suitable form, those used for the making of rod commonly being very long and narrow.

Such forms are not particularly undesirable when the finished product is solid, but where a hollow article, subject to expanding stresses in use, is to be made, the avoidance of inclusions of foreign matter is vital, and the form of ingot requires considerable modification.

In experiments which were carried out to minimize the occurrence of non-metallic inclusions, a form of ingot was adopted whose length was not great in proportion to the cross sectional area. The ingots made were 3 inches square and 30 inches in length, as compared with the ingots 6 to 7 feet in length and 1½ inch square section in common use. Steel-making practice was followed in introducing a hot sinking head or "dozzle." The molten brass is poured through the dozzle, which is filled to the top. No pipe is formed in the ingot proper and additions of metal may be made at any time to the metal in the dozzle without risk of introducing defects into the ingot, any dross rising to the top of the still fluid head.

The moulds were tapered, the top being enlarged by increasing amounts in successive experiments, and ingots were cast at the usual foundry speed. It was found that with a mould 3½ inch square at the top, tapering to 3 inches at the bottom, no shrinkage cavities were formed and the ingot appeared to be practically perfect as regards soundness.

By these methods, failures which previously reached large percentages were reduced to practically nil.

DISCUSSION

Dr. Rosenhain (National Physical Laboratory) said that in the earlier days of the Institute he pointed out that there was too much separation between metallurgical practice in iron and steel and that in the non-ferrous metals, and suggested that the two branches had a good deal to learn from each other. In the course of a long experience he could generally trace the troubles experienced in dealing with metals to the original ingot or the original metal in whatever form it reached the user. If they did not have a perfect ingot they could not get a perfect product, particularly when the work to be put on the metal was severe and extensive. All metals were subject to defects caused by non-metallic inclusions, defects which were smaller and more insidious than those due to cavities and similar faults. In ordinary circumstances people put up with defects to save expense. But that was likely to prove false economy seeing that the defects might mean the loss of a certain percentage of the product. By adapting ordinary steel practice to the treatment of brass Mr. Genders had obtained, as a matter of course, similar results. Emphasis was laid by Dr. Rosenhain on the rate of pouring which, he said, required more attention than was usually paid to it. Attention to the stream of metal would enable non-metallic inclusions to be avoided, whilst the other form of trouble might be avoided by remelting. The flow of the metal into the mold and the path it took might also be a cause of trouble in the cast metal. Ingots produced in long and narrow molds were very far from perfect on the exterior.

Mr. T. G. Bamford (Birmingham) whilst thinking the methods advised by the author were worthy of serious consideration considered that bottom feeding and bottom pouring, though they would eliminate a great many of the defects referred to, were methods very inconvenient to adopt in the practical work of a brass foundry. He had found a high pouring-temperature very useful in removing non-metallic and other impurities.

Mr. H. Moore (Royal Arsenal, Woolwich) said that in his opinion quite satisfactory results with castings of 1½ inch section and 7 foot length could be obtained. He entirely agreed with the conclusions of the paper.

Mr. R. J. Redding (Birmingham) said that with regard to some of the matter of the paper his experience was exactly opposite to that of the author. He did not see how in repeated drawings the non-metallic inclusion could escape revealing itself. With pouring from the bottom of the ladle there might still give solid inclusions. He quite agreed with Mr. Bamford as to the remedy being a high pouring temperature. The great things to be regarded were care in the mixture, casting at the right temperature, and care in the pouring. During the war at Southampton working entirely with untrained men and turning out enormous quantities of small arms ingots they never had a complaint. This was because the men were carefully directed and closely watched.

Mr. Genders in his reply said that he would deal in a written communication with most of the points raised. As to non-metallic inclusions, there were many instances in which they did not cause failure in the worked metal. He had examined dozens of cartridge cases which had quite big non-metallic inclusions but these inclusions did not cause failures because they ran round the walls and so could not possibly serve as a notch to start a fracture. If those cases had been made from the ingots by punching downwards the inclusions would have appeared longitudinally and failure in use would have resulted. Mr. Redding and others must not think that he was condemning the long narrow ingots. He did not do so at all because he thought it should be recognized that brass need not be free from inclusions unless its mechanical properties and not its surface were of importance. His whole paper boiled down to this, that when an article was made by elongation and elongated uniformly it was essential that inclusions should be avoided.

Density Determination of Copper-Zinc Alloys

A paper reviewing the work already done with regard to density determination of copper and its alloys, and giving an account of some investigations made at the University of Birmingham was contributed by Mr. T. G. Bamford, M. Sc.

*Part 1 was published in our November issue.

ABSTRACT

The density of alloys, the author points out, is important both from a theoretical and a practical standpoint. When the correct density is known, it is possible to determine whether casting conditions have been satisfactory. Hitherto no trustworthy determinations of the densities of the copper-zinc series have been available. The author, after reviewing earlier work, records experiments conducted with alloys made from pure metals, and cast in sand and chill-moulds respectively. The results indicate that there is a contraction in volume (i. e., increase of density) due to alloying with mixtures containing more than 25% of copper; and that the density of the sand cast (or slowly cooled) alloys is generally less than is the case with the chill castings, but that at points where the liquidus and solidus coincide on the constitutional diagram, chill castings and sand castings give the same values. These results afford striking confirmation of the data publish by Turner & Murray on the volume changes of the copper-zinc alloys. The expansion recorded by these observers with alloys containing less than 30% of copper is confirmed, and is shown to be connected with a new form of porosity different from ordinary unsoundness.

DISCUSSION

Prof. T. Turner (Birmingham) said that the methods described in the paper were bound to be of practical use and also of great theoretical value. In making use of density determination to ascertain whether or not a piece of metal was sound one must first know the true density of the metal or alloy. In the case of copper there had been considerable enquiry and the Engineering Standard Committee had published some results. One could not say a piece of metal was sound simply because it showed a clear surface when sawn, in many cases the sawing smeared metal into the holes. It was strange to think that although the brasses had been used for centuries people had gone on until quite recently without any determination of the density of the various members of the series. It was recognized that the rate of cooling and the amount of work put upon the metal altered the density. Mr. Bamford had given the maximum density that must be expected in cast metal, so that if a casting gave a lower density, one might reasonably assume that it was unsound. With regard to the possible theoretical value of density determination in metallurgy they had only to consider the valuable part that played in other physical and chemical investigations.

Dr. Rosenhain agreed as to the theoretical possibilities of the method. It was quite true, he said, that so far the study had been barren of results from a practical point of view as far as the alloys were concerned. New ideas upon the structure of matter and of metal in particular had been put forward, and he thought it would be possible to extend those ideas to the internal constitution and properties of inter-metallic compounds.

Experiments in the Working and Annealing of Copper

This paper was presented by Dr. F. Johnson (Birmingham).

ABSTRACT

The paper is divided into three sections and represents some exploratory work suggested as the result of previous work, and upon a limited amount of material left over therefrom.

Section I furnishes evidence in favor of the probability that the "critical ranges of deformation," previously discovered and shown in strength-reduction curves, etc., result from stages of abnormal plasticity during roiling of the metal. It is suggested that during these stages the metal actually loses some of the increase of hardness conferred in earlier "passes."

The volume-changes which take place show a decrease of volume up to 85 per cent. reduction. There is a maximum specific gravity at this point. The increase of volume which here sets in may correspond to the inception of permanent disability in the metal, which, as shown in Section II of the paper, cannot be eradicated by annealing.

Section II describes annealing experiments on copper-strips representing successive stages of reduction from 18 to 98 per cent.

At 200° C. for 1 hour unmistakable softening occurs in all strips rolled beyond 40 per cent. reduction, the most severely-worked strips, showing the greatest amount of softening. It is shown that test-pieces taken from the axes of the strips undergo softening to a greater extent than edge-specimens from the same series when annealed under the same conditions, thus indicating a greater intensity of strain at the centre than at the edges. High-temperature annealing (750° C.) shows that at 87 per cent. reduction a rapid increase in strength sets in and values as low as 9.4 tons per sq. inch were obtained with air-annealed specimens.

Section III deals with the low-temperature annealing of cold-drawn copper rods of varying compositions. "Tough-pitch" arsenical rods retain their strength practically unimpaired up to 300°C., whereas "touch-pitch" electrolytic copper undegoes considerable loss of strength. The presence of silver in arsenical rods slightly raises the annealing temperature.

The substitution of iron for oxygen in arsenical copper retards the rate of softening, the softening range of temperature being widened.

The paper gave rise to no discussion.

Cold Drawing of Low Tin Bronze

The next paper presented was that by Mr. W. E. Alkins and W. Cartwright on the effect of progressive cold drawing upon some of the physical properties of low tin bronze which was introduced by Mr. Cartwright.

ABSTRACT

In the present paper are given the results of an experimental enquiry into the effect of progressive cold-drawing upon the tensile strength, specific volume and scleroscope hardness of a bronze with rather less than 1.0 per cent. of tin. It was not found possible to get the three samples of metal used from the same billet, with the result that the tin content varied from about 0.7 to about 1.0 per cent. in the three samples studied, thus precluding a very rigid comparison of the results for the three series. Die sample was heavily drafted from three-eighths inch bolt; another was lightly drafted from bolt of the same diameter, while the third was heavily drafted from nine-sixteenths inch bolt.

The results for the three series agree remarkably well. They show conclusively that the variation in physical properties with reduction is very different at different stages in the reduction. The most important and rapid changes in properties occur after a reduction of 85 per cent of the original area: it is precisely over the range where practical difficulties are met with during drawing that the most pronounced variation in properties is found. The extent of the variation in the three properties is very similar to that previously found in the case of copper. The actual curves, however, look very different in some instances from those for copper, but the authors are of the opinion that the differences are probably differences in degree rather than differences in kind.

DISCUSSION

Dr. Johnson remarked that the specific volume reduction curves on Page 14 showed a similarity in type with the specific gravity reduction curve obtained in his own work on copper.

Prof. C. H. Desch (Sheffield) said the figures given with regard to what occurred in the final stages of drawing appeared to show that in the last reduction there was a real overdrawing of the metal.

Dr. Rosenhain asked whether the alloys when used in those wire drawing experiments were really in a state of equilibrium. This might play an important part in the matter of density.

Dr. C. Thompson (Manchester) thought the results could not be explained merely by over-drawing.

Mr. Alkins in reply said that the wire was subjected to the usual methods of wire-drawing. At present the authors could give no explanation of the results.

Second Session

Extrusion Difficulties

On the Institute resuming its proceedings at the Municipal Technical School the President (Sir George Goodwin) being again in the Chair, Mr. R. Genders presented his paper on "The Extrusion Defect."

ABSTRACT

Experiments have been carried out with the object of devising a method of extrusion which would avoid the formation of the defect (known by the misleading term "piping") which is commonly found in a certain proportion of centrally extruded rod made from brass and other non-ferrous alloys by the usual hot-extrusion process. The defect is tubular in the interior of the rod and generally exists in the last portion (up to 25 or 30 per cent.) extruded. When a defective rod is broken across, the core frequently breaks at a different point from the outer ring and projects and is sometimes quite loose. It has been shown that the defect consists of foreign matter, oxide and dezincified brass, which constituted the skin of the original billet.

Billets extruded to various stages and sectioned axially show the presence of the defect in the shape of a funnel, (formed by the turning inwards of the billet skin which cannot flow along the side of the receiver owing to friction and its lower temperature) by the fact of the ram, and its gradual flow toward the die. The defect can be largely overcome by the use of a ram smaller in diameter than the billet, which causes the outer layer of the billet to remain in the receiver as a thin cylinder, but the method would probably be too wasteful on a large scale. By inverting the process so that the die is pushed through the billet, the mode of flow is altered. There is no relative movement between the billet and receiver and flow is confined to the region of the die. Experiments on a small scale, using 60-40 brass billets and extruding under conditions comparable with large scale work, have shown this method to be successful in avoiding the "extrusion defect," the skin of the billet being turned over and collected on the face of the die, none entering the aperture of the die until the extrusion is nearly complete, when it emerges on the outside of the rod. The power required is less than with the method at present in use. Rod produced by the method is completely sound.

The method is in use in many places for the production of tubes and rod from soft metals although the plant appears to have been so designed only with a view to mechanical efficiency without any appreciation of possible effect on the quality of the product and has not so far, to the author's knowledge, been used for hot extrusion of copper alloys. The necessary modifications of the plant would probably be fully justified by the saving of the very large amount of metal which by the present method is extruded only to be ultimately scrapped.

DISCUSSION

Mr. Reading in opening the discussion said that the importance of the subject was not sufficiently generally appreciated. A defect where high explosives were used might mean the bursting of a gun, and this in the case of the navy might mean the loss of a ship. The troubles described by Mr. Genders had very largely increased since the war. That might be perhaps because the proportion of extruded to rolled rods had increased, if that were the case. Another reason might be the increase in the sizes extruded, because the defect was more general in large bars than in small. Perhaps the higher speed in working and the greater density of the skin caused by the higher pressure might be another explanation. The speaker described and illustrated with slides a series of experiments he had made on behalf of the Ministry of Munitions during the war. These were done with cylinders of wax, the outside of which was dyed red. The results, he said, showed that what went on was a process of some complexity and in his report he suggested that experiments with metal should be carried out on the lines suggested by the behavior of the wax models. Although the author of the paper did not think much of experiment with wax the speaker thought they did illustrate what would happen between the outside of the billet and the interior of the rod. The conclusions with regard to metal appeared to be much the same. He thought that makers of extruded rods should for their own credit experiment and see that the defect was finally removed. It was unsatisfactory to the engineer to know that he was working an article which could not be depended upon to give the full sectional strength required for his purpose. The result might be a prejudice against extruded materials.

Dr. Rosenhain said that the National Physical Laboratory came across the problem five or six years ago, because they found that certain alloys could not be readily worked otherwise than by extrusion, and after extrusion could be worked, rolled or treated in almost any way to an extent not possible before. In trying to discover the cause of coring they adopted the method of Mr. Genders, but used plasticine in layers each of the same degree of consistency but differently colored. They knew, of course, that such experiments with models could not be regarded as quantitatively similar to the behavior of the metal used in practice. But from these experiments they were able to devise modifications of extrusion practice which, to a very large extent got over the difficulties. He did not think that in the majority of cases the central defect was due to the external skin. In a great many extrusion processes, a considerable amount of clearance was given between the circumference of the ram and the container. This had some advantage in regard to the oxidizing effect, but the method adopted as the result of the plasticine experiments was to place between the ram and the metal a friction plate flat towards the ram, and deeply corrugated on the side next the metal. That prevented the oxidizing surfaces from flowing at all and the damage was prevented, but the real cause of defects in the majority of cases, one which Mr. Genders had rejected upon what he (Dr. Rosenhain) considered insufficient evidence was defect in the ingot. If an ingot were put in the press with the shrinkage end towards the ram, the material at this end would form a central area right down the bar. By turning the ingot the other way up

this defect was avoided. The suggestion of pushing the die into the metal was excellent in many ways, but he thought the high pressures put on the ram would in most cases prevent an insuperable difficulty. One of the great difficulties of the extrusion process, particularly during the war, was that of obtaining a ram which would stand up to the work.

The experiments with plasticine mentioned by Dr. Rosenhain were illustrated by a series of photographs, a lucid and interesting description of which was given by Mr. Fred S. Tritton of the National Physical Laboratory.

Mr. H. Moore of the Royal Arsenal, Woolwich, suggested that Mr. Genders had scarcely done justice to the earlier experiments which were carried out with metal under manufacturing conditions. The speaker did not agree that extrusion defects were due to any large extent to defects in the ingots. In the experiments to which he referred, every precaution was taken to ensure the ingot being perfectly sound, and the billets were tried both ways up. In every case the defect was formed, and was formed in the last 30 per cent. of the rod extruded. That seemed to him inconsistent with the defect originating in the ingot. Of course, if an ingot were defective the rod would also be defective. As to the weakness of the ram, the pressure was very much less when the die was pressed into the metal than when it was used the other way; the flow of the metal was very much easier and there was actually less work done in extruding. He believed that most of the extruded rods now made were extruded through multiple dies. In that case the flow of the metal was altered considerably, and the defect did not occur to any serious extent.

The President, following up a similar appeal by Mr. Moore, asked for contributions to the discussion from manufacturers, but received no response.

Mr. Genders in his reply said that the fact that no manufacturers came forward made him feel that those meetings were somewhat one-sided. They did their best to make experiments and give information but they seemed never to get any co-operation or criticism from actual makers (Applause). The effects when experimenting with brass were different from those obtained with plasticine. A clearance between the ram and the container so that the ram missed the skin of the billet would often avoid the defect, but there was a danger of getting the defect on one side. He did not think giving the ram a rough end would have any effect in actual manufacture except just near the edge. Any remedy which did not materially alter the mode of flow in the process as at present carried out would not reduce the effect to any appreciable extent. He would very much like to see some experiments made upon a larger scale, but unfortunately it was rather difficult to get anyone to put down a sufficient sum of money.

The Scleroscope

Mr. Fred S. Tritton gave a summary of his paper on "the use of the Scleroscope on light specimens of metals."

ABSTRACT

Some experience in the use of the scelroscope for testing the hardness of small pieces of metal in the laboratory led the author to doubt whether the real hardness values of small samples were obtained, although the usual precautions were taken to support the specimens in an apparently rigid manner. The experiments were undertaken with the view of finding out whether errors existed when using the ordinary methods of support and, if so, to find some method of support that would eliminate them.

Errors were detected, and to reduce them the author selected two materials, respectively pitch and glucose, for the purpose of supporting the speciments in the scleroscope. The use of pitch requires a special clamp, a new type of which is described. On the other hand, without the use of a clamp, a solution of glucose considerably stiffer than treacle was found to give excellent results, the specimens under test being simply attached by means of the glucose to a hard steel base. In this way there could be readily tested the hardness of specimens having not merely flat but curved surfaces—such as balls or rollers—provided that a recessed support be made to fit the specimens.

DISCUSSION

Sir Thomas Rose of the Royal Mint said that they had found the scleroscope very useful as a means of seeing how the men were getting on in the workshop and what happened in the course of rolling, annealing, etc. That perhaps was the main use of the sceroscope for most people. The actual figure was not of very much importance. It was the most comparative figures in the same workshop which were useful.

Captain Hartley (Woolwich) suggested that heat generated by the vibration might cause some crystalization and possibly some action of annealing.

Dr. Hatfield (Sheffield) thought that while the communication showed a very wide circle of applications of the scleroscope, its use should be restricted as a rule to those conditions where the Brinell test did not apply. The Brinell test was the more quantitative and reliable test where it was applicable.

Mr. H. L. Heathcote (Rudge, Whitworth, Ltd.) described tests done on steel balls in his company's laboratory. The balls, he said, were all of equal hardness, but the scleroscope readings varied by as much as 100 per cent. They had been very successful with a modification of the Brinell test.

Mechanical Properties of Zinc

This paper was presented by D. H. Ingall, M. Sc., Member (Birmingham).

ABSTRACT

The polishing and etching of cast and rolled zinc are investigated in detail. The mechanical properties of pure rolled zinc with a reduction by rolling of 77 to 96 per cent are determined for the following conditions: (1) As rolled, (2) annealed for thirty minutes at 100° C., (3) annealed for thirty minutes at 150° C., (4) annealed for thirty minutes at 200° C. It is found that:

(*a*) Only average values for mechanical properties are obtainable, as the material is variable.

(*b*) With the material as rolled and also when annealed at 100° and 150° C., it is ductile "with" and brittle "across" the direction of rolling, with reductions from 77 to about 87 per cent.; it is ductile in all directions with 96 per cent reduction by rolling, where the strength has risen from about 6 to about 13 tons per square inch.

These changes are obscured by the microstructure, which is an equi-axed structure in all cases.

(*c*) Annealing for thirty minutes at 200° C. renders the material completely brittle and weak, due to a crystallization.

DISCUSSION

The discussion was opened by Professor T. Turner, who said that 35 years ago much zinc was rolled in the Birmingham district, but the industry just before the

war had considerably declined. It was a disappointment that by this time large quantities of Australian concentrates were not being dealt with in Great Britain. He believed, however, that a big trade in rolled zinc and in zinc work of every kind would ultimately be developed. They now knew that pure spelter could be rolled with very excellent results. With regard to the etching of zinc he agreed with Mr. Ingall that the best results for micro-graphs could be obtained by slow etching, and it was therefore desirable to use a dilute reagent.

Mr. A. B. Thornewell (Oldbury) gave a number of results of his own which he compared with those of Mr. Ingall. He added that the most important property of rolled zinc was its ductility. He had only been able to connect this broadly with chemical composition. One could have a big variation, even of the so-called deleterious elements, and still have a good merchantable sheet. He had also tried to correlate microstructure with ductility but without success.

Aluminium Alloys and Age-Hardening

A paper on the age-hardening of aluminium alloys by Dr. D. Hanson and Miss Marie L. V. Gayler was introduced by Miss Gayler.

ABSTRACT

Constitution of the Alloys. The constitution of a small portion of the ternary system, aluminium, magnesium, silicon, has been investigated, namely, that containing up to 35% magnesium and 11% silicon.

The results of thermal curves and microscopic examination prove that in these alloys, magnesium and silicon form a chemical compound having the formula Mg_2 Si. This compound and aluminium form a eutectiferous binary system, having a eutectic containing 13% of Mg_2 Si. and melting at 590° C. Two ternary systems are formed with silicon and magnesium respectively. The aluminium —Mg_2 Si—silicon system possesses a ternary eutectic that melts at 550° C.; the ternary eutectic of the aluminium—Mg_2 Si—magnesium system melts at 450° C.

The solubility of the compound Mg_2 Si in solid aluminium has been determined, and the results show that Mg_2 Si is more soluble at high than at low temperatures, 1.6% Mg Si being held in solution at 580° C., and little more than 0.5% Mg_2 Si at 30° C. Excess of silicon has little effect on the solubility of Mg_2 Si, but magnesium reduces the solubility at high temperatures.

This difference in the solubility of Mg_2 Si in solid aluminium at high and low temperatures is the cause of the age-hardening property of these alloys.

Age Hardening of the Alloys. The alloys of this system, after quenching from high temperatures, are relatively soft, but gradually become harder; this age-hardening ceases after a few days. The age-hardening of a series of alloys containing increasing amounts of Mg_2 Si rises progressively until the limit of the solubility of Mg_2 Si in aluminium at the quenching temperature is reached, beyond which the total increase in hardness remains constant. Hence the increase in hardness produced during the ageing of the alloys is roughly proportional to the amount of Mg_2 Si retained in solution by quenching. Confirmation of this view is also obtained from experiments with alloys of aluminium and Mg_2 Si with magnesium or silicon.

Professor Desch described the paper as a model of what a paper on thermo-analysis should be and the micrographs shown as representing entirely what they were supposed to represent and not requiring the exercise of faith. He regarded as entirely unassailable the conclusions come to by the authors.

Mr. H. Moore joined Professor Desch in commendation of the paper. He stated that his own experiments and observations showed that in binary alloys, such as aluminium with zinc and aluminium with magnesium, age-hardening was unusual, and when it occurred was not at all comparable with that which took place in alloys of the ternary or quaternary series. The age-hardening of ternary alloys which had come under the speaker's notice seemed to him scarcely attributable to the separation of magnesium silicide, as they contained only a trifling amount of silicon.

Dr. Hanson in his reply said that the silicide compound appeared to be very stable, it had a very characteristic appearance under the microscope, and even in unetched specimens could be easily traced by its beautiful blue color. Magnesium formed a great many compounds in aluminium alloys, but it seemed to fuse silicon more readily than anything else and silicon was a constant impurity in aluminium. It was always possible for enough silicon to be present to compound with magnesium because a very little would be sufficient. The authors, however, did not suggest that for the occurrence of age-hardening the presence of that compound was essential.

Electrolytic Etching

The next paper was one by Mr. Frank Adcock describing "The Electrolytic Etching of Metals."

ABSTRACT

As the title implies, electroyltic methods of etching various metals are described with a view to the preparation of useful micro-sections.

A solution of citric acid as an electrolyte in the etching bath yielded good results with cupro-nickel (80:20), silver, nickel-silver and some other metals, and it was noticed that silver and nickel-silver specimens which had been comparatively roughly treated during the polishing process often gave clearer etchings than the specimens which had been polished with great care. Certain specimens of silver showed on etching a cell structure or network which was smaller than, and in some cases independent of, the existing crystal grains.

Another electrolyte made by dissolving molybdic acid in excess of ammonia solution gave somewhat similar results and revealed a subsidiary cell formation or net-work in the "Beta" regions of a beta plus gamma brass containing 6% of aluminium.

By making use of such reagents as hydrofluoric acid, chromic acid, and bromine water both the cores (or dendrites) and the crystal grain boundaries of cast cupro-nickel were disclosed simultaneously.

The paper is illustrated with eighteen photomicrographs and concludes with some notes on the etching of gold and platinum.

Electron Metal

The last paper was a note on "The Magnesium Alloy 'Electron,'" by S. Beckinsdale, Woolwich.

ABSTRACT

Samples of the new high magnesium alloy "electron" examined by the author contained about 95 per cent. of magnesium, 4.5 per cent. of zinc, and 0.5 per cent. of copper. They were in the form of rod, probably extruded at a raised temperature; one sample showed evidence of having been subjected to cold heading. The alloys machined well, and compared very favorably with aluminium alloys in tensile properties (allowance being made for the much lower specific gravity), but they were not so ductile in compression.

Modern Development in the British Brass Industry

A Discussion Is Given Embracing: Electric Brass Furnaces in England; the Extrusion, Hot Pressing and Forging of Brass; Rolling Mill Practice; Annealing; Composition of Industrial Brasses; and Treatment and Utilization of Scrap Brass—Part 2[1]

By ERNEST A. SMITH, A.R.S.M., M.Inst.M.M., British Non-ferrous Metals Research Accoc., Birmingham, England

The choice of furnace for brass melting is largely regulated by the class of work to be done. For comparatively light casting of carrying weight and composition the coke or gas-fired pit furnace is generally preferred, but for large quantities of metal of uniform composition required at regular intervals for heavy class work the tilting furnace, either coke or gas-fired, is found to be more efficient and economical, owing to the lower fuel consumption, longer life of crucible and less labor required. The crucible capacity for small size tilting furnaces is usually about 120 to 150 lb., but the larger furnaces have a maximum capacity of 1,000 to 1,200 lb. Crucible tilting furnaces of relatively large capacity developed during the ten years previous to the outbreak of war found extensive use during the war period. So far was this the case that taking into consideration the tilting furnaces existing before the war together with those installed for war work, it is probable that about one-third of the total annual output of brass in recent years was melted in tilting furnaces. The average all-round working heat efficiency of the coke-fired crucible tilting furnaces on 70:30 brass is stated to be about 15 per cent. Preheaters are attached to most of the modern crucible furnaces in use both for pre-heating the metal charge and in some cases the air supply.

Reverberatory or air furnaces capable of melting several tons of metal are in use where large quantities of metal are required for heavy castings. These are usually coal-fired, but the application of gas-firing is receiving attention and has been adopted in some cases. For large quantities such furnaces are more economical and speedy to use than a number of smaller furnaces, and give a product more homogeneous in composition. When several small furnaces are used it is difficult to collect the pot charges into a ladle, and keep the metal warm enough for casting.

ELECTRIC FURNACES IN GREAT BRITAIN

The application of electrical energy for melting brass and other copper alloys offers many advantages, and the development of furnaces of this type on the Continent and in America is being watched with great interest. So far, the high cost of power has done much to delay more adequate attention being given in England to electric melting, but there is little doubt that a substantial reduction in electric power costs will bring these furnaces into greater prominence.

Owing to the comparatively low temperatures involved in melting most non-ferrous metals and alloys as compared with iron and steel, the electric furnace has not yet, on financial grounds, justified its employment for brass and similar alloys, except when dealing continuously with comparatively large quantities of material of uniform composition. The accurate control of working temperature and atmosphere, however, which the use of electric furnaces confers appears to mark it as one of the furnaces of the future.

Electric furnaces of the resistor type, in which a crucible is either heated externally or itself acts as the resistor, appear to be the type that appeals most to the brass melter, especially if provision is made for lifting the crucible out of the furnace to permit of hand-casting. Several forms of transformer furnaces for melting brass have been developed in England and on the Continent, and in this type the carbon crucible acts as the resistor to the passage of the alternating current and thus generates the necessary heat. This type of furnace is preferred because it conforms to the more varied requirements of general brass foundry practice, where usually comparatively small quantities of a number of alloys of different compositions have to be handled. Several furnaces of this type with a capacity up to 100 lb. or more of metal have been introduced in recent years and are being experimented with at several works. In cases where large quantities of one or two particular alloys only have to be dealt with, and for the melting of scrap, etc., electric furnaces of large capacity up to one-half ton or more are in use, but are so far in the experimental stage.

There would appear to be comparatively little scope in the British brass industry for electric furnaces of large capacity such as the Ajax-Wyatt, Detroit Rocking, and the Baily, in which the bulk of the electric brass melting has been done in America. These furnaces require large and expensive installation and must be operated continuously on one or at most two standard alloys before any material saving can be shown. These conditions do not apply to a large majority of the British works, many of which have only an average monthly output of from 500-600 lb. or even less and are called up to supply such a variety of alloys and products that they cannot economically operate a furnace of one-half to one ton capacity continuously.

In addition to the introduction of newer types of furnaces considerably more attention has been given in recent years to details of casting technique, such as temperature of the metal, rate of pouring, dressing of molds, etc., all of which are important factors in the production of sound metal. In this connection mention must be made of the use of the fireclay dozzle or feeder head which has been strongly advocated by W. R. Barclay and others during the past five years, for the production of sound ingots as free as possible from pipe. As is well known, such dozzles have long been used in crucible steel casting and have done much to render the "feeding" of the molten metal into the ingot mould more efficient.

The hot dozzle inserted at the top of the ingot mould acts as a small secondary crucible holding the metal in the liquid state at least sufficiently long to allow it to be drawn into the interior of the ingot as required by the shrinkage cavity.

Where the feeder head has been introduced it has been of considerable assistance in producing sound brass ingot metal. The usual method of pouring adopted by the brass caster differs however from the steel caster's method and militates against the use of the feeder head, consequently when the non-ferrous metal caster employs the feeder head he must conform more closely to the steel

[1]Presented as part of a symposium on non-ferrous metallurgy at the fortieth general meeting of the American Electrochemical Society held at Lake Placid, in the Adirondacks, September 29, October 1, 1921. Part 1 was published in our November issue.

caster's method. An objection sometimes urged against the use of the dozzle is that it can only be used once and is then scrapped, but although this is the case experience has shown that the initial cost of the dozzle is invariably covered by the larger percentage of sound ingots that result from its intelligent use.

With regard to general foundry work some type of molding machine is now almost universally employed for repetition work in which large numbers of duplicate castings are required. There has been a considerable extension in the use of moulding machines during the past few years and in this respect British manufacturers are indebted to American inventors for many of the most serviceable machines in use.

EXTRUSION OF BRASS

Closely allied to the casting of brass is the shaping of the metal by the extrusion process in which the hot metal, while in a more or less plastic condition is forced by heavy compression through a die, from which it "extrudes" in the form in which the die has been cut.

In no section of the brass industry has development been more rapid in recent years than in the production of rods and sections by the extrusion process, which was invented by Alexander Dick and developed by the Delta Metal Co., Ltd. Before the war the extrusion process was little known apart from one or two British firms who had specialized in the process and brought it into almost everyday use. The methods adopted were jealously guarded and the knowledge of the process in actual practice was confined to only these few firms. As a result however of the imperative demand for a large and rapid production of brass bars, extrusion presses were fitted up and installed in many works to meet the demand; with the result that the use of extruded bars and sections received a great impetus. A number of firms having equipped their works with the necessary machinery for the process are now actively interested in the production of extruded material, and are giving the industry the benefit of their equipment and experience so that a considerable quantity is now being produced for industrial purposes. The demand for suitable presses for extrusion has been well met by British engineers, who supply hydraulic plant with 600 to 1,000-ton presses, capable of extruding brass bars up to 3 inches drawn from standard billets of 5.25-inch diameter by 24 inches long. Amongst the more prominent makers of extrusion plants are Messrs. Fielding & Platt, Ltd., of Gloucester, Henry Berry & Co., Ltd., Leeds, and Davy Bros., Ltd., Sheffield.

Brass of the ordinary 60:40 composition is most suitable for strong extrusion work and is the most widely used alloy, being soft and easily extrudable when hot. When alloys of other compositions are used they have to be governed by their capacity for "flowing" when heated for extruding. With an increase in the copper content the metal becomes harder and more difficult to extrude. A 600-ton press will satisfactorily deal with brass up to about 62 per cent., but larger presses are required for extruding metal of higher copper content.

Special brasses containing small percentages of other metals such as iron, manganese and aluminum to give additional strength are also being extruded satisfactorily, the added metals having but slight effect on the extruding properties provided due regard is paid to the quantity added. The extrusion process has many advantages over the older methods of rolling and drawing, and there is every prospect that the process will be considerably extended in the future.

The ease with which sections, many of which are very complicated, can be produced by the process, practically to size, at one operation, together with the fact that sections can be extruded that would either be impossible or extremely difficult to produce either by rolling or drawing, no doubt largely accounts for the increased favor which the products of this method of manufacture are finding.[2]

The making of tubes and hollow sections are included in the newest applications of the extrusion process, the difficulties at first encountered in their production having now been successfully overcome.

So far as the manufacture of solid drawn brass tubes by the ordinary process of drawing is concerned there is little advance to be recorded in the actual appliances used, but manipulation has been modified in the light of modern research especially in its relation to season-cracking, to which brass tubes drawn through a die are somewhat susceptible.

HOT PRESSING AND FORGING

Another section of the brass industry that has developed greatly during recent years, and is today of considerable industrial importance, is the manufacture of light parts by the process of pressing a heated billet to a definite shape in suitable dies. In some cases the metal is stamped cold but the more general practice is to heat the metal to a suitable temperature before subjecting it to pressure. Brass of 60:40 composition has been found in general practice to give the most satisfactory results owing to its good forging qualities, but brass of other compositions is also employed.

Extruded rod is extensively used as raw material, though cast bar is used in many cases. The pressures employed vary from 70 to 400 tons, although 200 tons available pressure is capable of dealing with a large number of the articles manufactured in brass. The most suitable temperature for the hot-working of brass varies with the composition, and has been the subject of recent research. "It would appear that the work done during compression diminishes with increasing temperature from 500° C. onwards, at first rapidly and then more slowly. For copper, the work required at 800° is about one-third of that required at 500°, and the influence of temperature becomes more strongly marked in alloys containing 12 or 15 per cent. of zinc. For brass with 28 per cent. of zinc, the work at 800° is one-quarter of that at 500°, and for brass with 37 per cent. of zinc, one tenth. In the last case three times as much work is required at 700° as at 800°. As soon as the β phase makes its appearance the work becomes less, and at 42 per cent. brass may be compressed at 500°, and the full softness is reached at 700°. α brasses are therefore best worked at 800° C., higher temperatures being undesirable on account of burning. At this temperature, all the alloys examined undergo the compression of 50 per cent. without cracking Most of them have been compressed 80 per cent. without cracking. The work required at all temperatures increases with increasing zinc content to a maximum at 15 per cent. of zinc and then rapidly diminishes to a very small value in the α β region."[3]

The speed of working and the flow of the metal are important considerations in hot-pressing. The advantage of the die-pressing process is that the piece being produced under heavy pressure, is very close grained and free from the defects such as blow-holes and pin holes, not infrequently met with in brass castings. They also have a smooth surface and no hard skin as in castings, and require little or no machining.

The machineability of brass is a matter of great importance, and has received a large amount of attention during the war period. Among the most important investigations on this subject may be mentioned that by C. H.

[2] The Metal Industry. No. 19, 1920, 17, 404.

[3] Journal Institute of Metals, 1921, 25, 398.

Desch who conducted experiments to ascertain why brass rods of approximately 60:40 composition had been found to give widely differing results on machining. He found that the presence of small percentages of metals other than copper and zinc changes the relative proportion of the alpha and beta constituents, and that the most desirable structure for machining purposes was an arrangement of fine fibrous alpha crystals separated by a comparatively small quantity of beta. This could be obtained by the employment of an alloy containing as nearly as possible 40 per cent. "apparent" zinc, i.e., with the added metals calculated to the equivalent quantities of zinc, and by the use of moderate temperatures and powerful presses in extrusion of the rods. It was found that brass of good machining quality should contain as nearly as possible 60 per cent. of copper and 1.5 per cent. lead, with a minimum percentage of other metals.

ROLLING-MILL PRACTICE

Although there is no marked advance in brass rolling mill practice, a number of mills of improved design have been installed during the past ten years and better work is being produced than formerly.

Both in England and in America there is need for a much closer study of the factors which tend to soundness of ingots, which is of such vital importance in the production of sheets of high-grade quality.

The production of a superior finish to sheet brass is not however altogether a question of a sound ingot or of good rolls, important as these factors are, but is to a large extent dependent on the exercise of scrupulous cleanliness in all the details of the rolling operations. It would appear to be in this direction that improvement in British rolling practice is to be sought. One important factor that operates against the British sheet brass roller is that he is not generally able to confine his rolling to comparatively large orders of one class of material which are so conducive to economic production, and which pertain to most Continental rolling mills. More frequently he is called upon to supply small quantities of material varying in composition and gauge, which adds considerably to the cost of rolling and militates against superior finish when the same rolls are used for all classes of work. The speed of rolling varies with different manufacture and whether the metal is hot or cold rolled. The generally recognized speeds for cold rolling are approximately as follows:

	Ft. per Min.
Breaking down strips	20 to 40
Finishing sheets	60 to 80
Finishing sheets	80 to 100
Finishing rods	100 to 120

The amount of reduction given depends upon the material and the temperature of anealing. On breaking down mills of large sizes for non-ferrous metals generally very heavy pinches have been employed, being in some cases as much as ½-inch, but a common practice is ⅜-inch. In the later stages reduction from 2.5 to 1 gauge is still general. It is to be regretted that so little reliable data on the best conditions for brass rolling has been published. Present day British practice is to a large extent based on empirical knowledge and there is urgent need for systematic research into all the factors governing the best economic operative conditions for rolling the industrial brasses, such as percentage reduction, number of passes to obtain given reduction, speed of rolling, amount of pinch in the initial stages, temperature of hot-rolling, etc., all such factors being studied in connection with the temperature and time of annealing.

ANNEALING

For annealing purposes gas-fired furnaces of the close annealing type have been largely introduced in place of the old open bed coal-fired furnaces, and the temperature controlled by pyrometric observations in compliance with the more exact knowledge on heat treatment resulting from modern research. The installment of modern furnaces has considerably lessened oxidation during the annealing process and in consequence reduced the cost of manufacture through obviating the necessity of removing excessive scale. In this connection it may be pointed out that in several instances salt baths have been introduced for annealing small brass articles with considerable success and reduction in finishing costs.

The average gas consumption per 100 lb. of metal annealed, including gas used for preliminary heating of the furnace, and town gas of net calorific value of about 500 B.T.U. is given by Hartley as follows:

NATURE OF WORK	GAS CONSUMPTION IN CU. FT. PER CWT. METAL ANNEALED
Light brass stampings	100 — 125
Heavy brass stampings	150 — 200

The temperatures employed for annealing, and the time required to complete the operation, are of course dependent on the composition and nature of the metal to be treated, but it may be stated that much closer attention is now being given to this operation, with the result that there has been a considerable improvement in the subsequent mechanical treatment and finishing of the material.

COMPOSITION OF INDUSTRIAL BRASSES

The figures given in the accompanying Table I may be taken as representative of the composition of the bulk of the ordinary brasses now being manufactured for industrial purposes, and of which thousands of tons are pre-

Table I.

APPROXIMATE COMPOSITION OF BRASSES.

Trade Names	Percent Copper	Zinc	Uses
Brazilng Metal	66–67	34–33	
Brass for extrusion and hot-pressing	60	40	
Brown Metal	87–88	13–12	For buttons, badges, etc. The metal polishes to a golden color.
Cap Metal	97	3	For shell-caps.
Best English Brass (Cartridge Metal)	70–72	30–28	For deep stamping and drawing, brazed tubes, etc.
Dipping Metal	73–74	27–26	For articles that require strong brazing or hard soldering.
Enameling (Tombac Gilding)	92–93	8–7	Used in jewelry and art metal trades. Enamels well.
Gilding Metal	90–91	10–9	
Ordinary Brass (Yellow Metal) (Muntz .Metal)	60–62	40–38	Sheets, tubes, etc.
Princess Metal Tombac Brass, Similar Metal	81–82	19–18	Sheet, wire, etc.
Solder	50	50	
Stamping Metal	65	35	High class deep stamping alloy.
Turbine Blading	70	30	For low pressure steam.
Wire Brass:			
Ordinary Brass Wire.	62–63	38–37	Weaving, cutting up in automatic machines, etc.
Better quality	64–66	36–34	
Brazing Wire	70	30	
Solder	73	27	
Union Wire	75–81	25–19	
Gilding Wire	90	10	
Spring Wire	95–98	5–2	Used by weavers in fine sizes.

pared annually. The extended use of brass for engineering and electrical purposes in recent years has resulted in a considerable development of the brass trade, but now that the enormous demands for brass for war purposes have ceased, manufacturers are earnestly seeking new uses for the metal so that production may not have to be curtailed.

Considerable attention is being given to the development of the so-called high tension brasses for engineering purposes in which enhanced properties are conferred on ordinary brasses by the addition of comparatively small quantities of metals such as nickel, manganese, aluminum, etc. Many of these are very complex in composition and the exact influence of certain added metals is not completely understood, and their presence in some cases is of doubtful utility. To obtain the best results with these special brasses, improved knowledge of the true effects of the added metals is desirable so that endeavors may be made to simplify their composition.

The main object sought in the addition of other metals in commercial complex is to produce alloys, which, in the cast state, have a much improved yield point and maximum stress and increased hardness, with at least no serious loss of ductility; and, when rolled and forged, a still greater improvement in mechanical properties, as shown by tensile tests. It is difficult, however, to say exactly how much of such improvements are due to any particular added metal. Heat treatment is advocated in some cases, but experience appears to show that it lowers the elastic limit, and not as in the case of steel actually raises it. The complex composition of the special brasses in general use is illustrated by the examples collected in Table II. by O. F. Hudson. Examples of mechanical tests obtained with these alloys are also given in Tables III and IV.

In addition to these it may be mentioned that several firms that have made a specialty of high strength brasses are now producing an alloy containing about 4 per cent. of manganese which gives from sand castings:

—TONS PER SQUARE INCH— ELASTIC LIMIT	TENSILE	ELONGATION ON 2 INCHES
22.0	42-46	15-20 per cent.

The alloy is largely used for propeller blades, etc.

TABLE II.
COMPOSITION OF SPECIAL ALLOYS.

Alloy	Cu	Zn	Sn	Pb	Fe	Mn	Ni	Al
Aich's Metal	60.0	38.0	..	..	1.8	..	..	..
Sterro Metal	55.5	42.0	..	..	2.5	..	..	..
Sterro Metal	55.0	42.4	0.8	..	1.8	..	..	..
Delta Metal	60.0	35.5	1.75	1.4	0.75	..	..	..
Delta Metal	55.0	43.5	..	0.4	1.1	..	..	..
Delta Metal	58.3	39.0	0.06	0.15	0.13	0.14	2.2	..
Manganese Bronze	69.0	24.2	..	1.6	..	0.25	..	4.9
Manganese Bronze	58.5	38.5	1.4	..	1.6	0.02	..	..
Manganese Bronze	56.2	40.5	1.2	0.4	0.4	1.1	..	0.2
Manganese Bronze	56.0	39.6	1.2	..	1.1	trace	2.0	0.1
Manganese Bronze	54.9	41.7	1.4	..	1.2	0.5	..	0.4
Aluminum Brass	61.0	35.3	..	..	1.0	0.5	..	1.5
Iron-Nickel Brass	54.1	38.0	..	0.42	2.5	0.9	3.6	0.4

TABLE III.
MECHANICAL TESTS OF SPECIAL ALLOYS.

	Composition							Tensile Tests				
Alloy	Cu	Zn	Fe	Mn	Ni	Al	V	Condition	Yield Tons Sq. In.	Max. Stress Tons Sq. In.	Elong. Percent on 2 In.	Reference
Delta Metal	..	..	..	..	..	..	..	Square bar annealed	..	27.8	38	Law
	..	..	..	..	..	..	..	Flat plate annealed	12.1	30.0	36	"
	..	..	..	..	..	..	..	Flat plate	13.7	35.4	14	"
	..	..	..	..	..	..	..	Round bar	23.4	32.1	23	"
	..	..	..	..	..	..	..	Hexagonal bar	25.0	31.3	11*	"
Manganese Bronze	58.8	38.1	0.8	0.7	..	1.2	..	Cast (?)	13.6	24.2	22	Norris
Manganese-Vanadium Bronze	58.6	38.5	1.0	0.5	..	1.5	0.3	Cast (?)	22.6	36.4	12	"
Vanadium Bronze	..	..	..	..	..	..	.. Pb	Cold drawn 5/8 in. rod	35.7	41.1	11.5	"
Nickel-Iron Brass	54.1	38.0	2.5	0.9	3.6	0.4	0.4	Chill cast	13.2	32.5	43	Millington
	..	..	..	..	..	..	..	Sand cast	11.6	23.7	13.5	"

*Broke in ext. mark.

TABLE IV.
MECHANICAL TESTS OF SPECIAL ALLOYS.

	Composition								Tensile Tests			
Alloy	Cu	Zn	Sn	Pb	Fe	Mn	Ni	Al	Condition	Yield Tons Sq. In.	Max. Stress Tons Sq. In.	Elong. Percent on 2 In.	Reference
Delta Metal	60.0	35.5	1.75	1.4	0.75	..	..	..	Square bar annealed	..	27.8	39	Law
	55.0	43.5	..	0.4	1.1	..	..	..	Flat plate annealed	12.1	30.0	36	"
	58.3	39.0	0.06	0.15	0.13	0.14	2.2	..	Flat plate	13.7	35.4	14	"
	..	..	..	..	..	..	..	..	Round bar	23.4	32.1	23	"
	..	..	..	..	..	..	..	..	Hexagonal bar	25.0	31.3	11*	"
Mangan. Bronze	58.8	38.1	..	..	0.8	0.7	..	1.2	Cast (?)	13.6	24.2	22	Norris
Manganese-Vanadium Bronze	58.6	38.5	..	..	1.0	0.5	..	1.5	Cast (?)	22.6	36.4	12	"
Vanadium Bronze	..	..	..	..	..	..	..	..	Cast	12.1	31.7	32	"
									Cold drawn, 5/8 in. rod	35.7	41.1	11.5	"
Nickel-Iron Brass	54.1	38.0	..	0.4	2.5	0.9	3.6	0.4	Chill cast	13.2	32.5	43	Millington
									Sand cast	11.6	23.7	13.5	"

*Broke in ext. mark.

The special high tenacity brasses present a wide field of useful research, not only on the constitution of brasses with one or more added metals but on their mechanical and working qualities. Doubtless a large amount of information on this subject has been accumulated by manufacturers and others as the result of experience, but much of it is not at present or likely to be generally available.

TREATMENT AND UTILIZATION OF SCRAP AND RESIDUES

The enormous quantity of brass scrap which has accumulated as the result of the war has brought into prominence the question of the economic treatment and utilization of this class of material. Whilst a large proportion of the scrap from war material is of a more or less special nature, every brass foundry and every firm concerned in the manufacture of brass produces a certain quantity of heavy and light scrap turning, swarf, etc., and by-products such as ashes and skimmings, all of which have to be dealt with, and the way in which it is handled is a fairly good index to the efficiency of the works.

Most firms utilize their own heavy and clean light scrap, a certain proportion being added to each melting charge, and some foundries use certain of their own by-products. The majority of firms, however, find it is more economical to sell all by-products to a scrap dealer or smelter. Whatever the nature and quantity of the scrap material may be it is now generally recognized that a rigid system of collection and classification is of fundamental importance in its economic treatment whether utilized in the foundry or works producing it or disposed of to outside dealers.

During recent years there has been considerable development in the treatment of scrap on more scientific principles and new appliances have been introduced to facilitate such treatment. Amongst these may be mentioned: disintegrating machines for disintegrating bulky turnings or swarf; magnetting machines for removal of iron; briquetting machines for compressing turnings or swarf; annealing furnaces for softening "springy" brass scrap; bundling or bailing presses for compressing sheet scrap; gas-fired furnaces for sweating tin and solder off light scrap; hydraulic presses for compressing or collapsing cartridge and shell cases.

Ashes, sweepings and other by-products are usually crushed in a ball mill or similar appliance, the crushed material classified, and the metallic portion separated from the waste by passing over a concentrating table of the Wilfley type. Old crucibles are crushed and the larger pieces of metal picked out by hand or by screening, whilst the remainder of the material is put through the concentrator and the fine metallic portions collected and dried and then sent to the metal store for further treatment and analysis.

The question of dealing with brass scrap, to get it into a suitable form for melting has received considerable attention within recent years. A method which was developed during the war period and has been successful consists in mixing swarf with a certain proportion of fluxing material, and compressing into briquettes, ready for melting. A number of specially designed machines have been introduced to compress the material into a compact form ready for charging into the crucible. Powerful bundling or baling presses are in use where large quantities of bulky scrap sheet brass have to be dealt with. These machines, which are usually hydraulically operated, press the material into bundles or bales of an average size of about 30 by 18 by 6 inches, which are subsequently melted in small reverberatory furnaces.

With regard to heavy scrap which is usually returned direct to the foundry for remelting, experience during the war has shown that, where careful selection has been exercised, charges made up entirely of scrap have given castings and ingots equal in quality, and in some cases of superior quality, to that made from virgin metal either alone or with the addition of small percentages of scrap. This experience has modified the generally accepted conclusion prevalent before the war that not more than about thirty per cent. of scrap should be added to any charge. Whilst much necessarily depends on the class of heavy scrap available, and the nature of the work for which the remelted metal is required, there appears to be little doubt that a few carefully conducted experiments made under suitable work conditions with the material available would prove that in many cases a much larger percentage of scrap might be employed than at present with economic advantage.

This paper will be concluded in a subsequent issue.—Ed.

Silver on Steel Knives

Steel knives that are to be silver plated should be coated first with a strike-silver solution, high in cyanide and low in silver using steel anodes.

Water	1 gal.
Sodium Cyanide	6 ozs.
Silver Cyanide	½ "
Copper Cyanide	1/16 "

Some platers use two strikes, one, which is made up from cyanide only, is used as an electric cleaner with steel anodes.

Lead and brittania should be coated with a film of mercury before plating. Then use the strikes and follow with the regular silver plating solution.

The mercury dip for these metals is best prepared from sal ammoniac and bichloride of mercury.

Water	1 gal.
Sal Ammoniac	1 lb.
Bichloride of Mercury	2 ozs.

There must be something wrong with the silver solution when the silver deposit peals in scratch brushing, presuming the articles are thoroughly clean and free from oxide. To avoid this trouble use the mercury dip, or strike in a nickel solution, then in the silver strike, and finally plate as usual, unless the silver be plated direct upon brass bronze or copper. Your solution may need more soda cyanide. Add ½ oz. to 1 oz. per gallon and ¼ oz. sal ammoniac. Then silver deposit should be white enough. C. H. PROCTOR.

Flemish Finish

Flemish finish is obtained by plating in a solution made up from caustic soda and arsenic as follows:

Water	1 gal.
Caustic Soda	4 to 6 ozs.
White Arsenic	2 to 3 "

Or in a very weak nickel solution, two to three degrees Baume' consisting of

Water	1 gal.
Double Nickel Salts	3 to 4 ozs.
Common Salt	½ oz.

To this add a small amount of sulphate of copper, previously dissolved in hot water. The copper will produce a black finish. Use steel anodes.

You may also make up a dip solution for Flemish finish. Dissolve white arsenic in muriatic acid by the aid of heat until the acid will not take up any more. Add about two ounces of the muriate of arsenic solution to every gallon of boiling water and about 1/18 oz. polysulphide. Dip the articles in the solution until a grayish black is produced. This will require about a minute. C. H. PROCTOR.

THE METAL INDUSTRY

With Which Are Incorporated

THE ALUMINUM WORLD, COPPER and BRASS, THE BRASS FOUNDER and FINISHER, THE ELECTRO-PLATERS' REVIEW

Published Monthly—Member of Audit Bureau of Circulations

Entered February 10, 1903, at New York, N. Y., as second class matter under Act of Congress March 3, 1879

SUBSCRIPTION PRICE, United States and Canada $1.00 Per Year. Other Countries $2.00 Per Year :: SINGLE COPIES, 10 CENTS
Please Remit by Check or Money Order; Cash Should Be Registered

ADVERTISING RATES ON APPLICATION FORMS CLOSE THE FIRST OF THE MONTH

Palmer H. Langdon.....Editor and Publisher
Adolph Bregman.....Managing Editor
George W. Cooper.....Advertising Manager
Thomas A. Trumbour.....Business Manager

ADDRESS ALL CORRESPONDENCE TO
THE METAL INDUSTRY, 99 JOHN STREET, NEW YORK
Telephone Number Beekman 0404. Cable Address, Metalustry

Vol. 19 New York, December, 1921 No. 12

Contents

EDITORIAL

RUMORED COPPER AND BRASS MERGER

The unconfirmed rumor in the daily press that the Anaconda Copper Mining Company is negotiating for a controlling interest in the American Brass Company raises some interesting questions. The former company is capitalized at $150,000,000, and the latter at only $15,000,000. It should be no impossible task for the Anaconda to buy control of a concern one-tenth its size, even if the price should be (and it will be) somewhat stiff. The reason for such a move is, of course, obvious. The copper producers are among those who suffered most in the period of deflation and it is only natural for one in a position to do so to attempt to stabilize its domestic market by control of the largest consumer.

How this would affect the American Brass Company is problematical. It is accepted generally that this company, since it manufactures about 40 per cent of the brass produced in this country, occupies a position similar to that of the U. S. Steel Corporation in the steel trade. As a free agent it can buy its copper in the open market, and its orders are large enough for it to command respect from even the largest producers. Moreover, a large part of its strength is due to its ability to buy advantageously (certainly in such times as these), and it is very doubtful if, even during the time of greatest consumption, the American Brass Company could not get copper as easily, if not more so than any competitor. It probably always had sufficient sources of supply for raw material. Would it be just as free to buy at the market's best figure if it were controlled by a large producer?

So far as Anaconda is concerned this is, of course, only one step, but a most important one. Its output, although it is said to be one-third of the total output of copper by this country, would be only about 25 to 33 per cent more than the needs of the American Brass and its branches. This would place it in a more advantageous position compared with the other copper producers. It is not at all certain, of course, that American Brass would buy all its copper from its controlling corporation, but even a large part of it, taken regularly, would greatly improve Anaconda's market. In addition to this there is also to be considered the large zinc tonnage which Anaconda now produces.

Such an acquisition would be a tremendous move in that it would change the whole policy of the brass and copper industry in this country. The producers on one hand, and the fabricators on the other, have always maintained a wide space between them. The producers have risen in meteoric style during the last twenty-five years, while the fabricators have grown very slowly but steadily over a much longer period. The producers have made the world their market, so that half or more of the copper goes abroad. There are no gigantic combinations in the fabricating industries, but rather several old, solid, conservative concerns, some even personally (or, at any rate, very closely) owned, with a number of small companies, many of which had a hard struggle to exist. The difficulties of breaking into the fabricating industry, due to the need for a very special, and somewhat rare, type of labor, the canniness of those engaged in it (and also their customers) have kept even the most powerful producers out of it and forced them to keep their expansion in a horizontal plane. Anaconda, however, is already making electrical wire and has therefore some idea of the fabricating industry. The fact that this company, great as it is, may choose the purchase of stock in a going company as its method of entering further, may have a definite significance.

INDUSTRIAL CONFERENCE BOARD

The National Industrial Conference Board is an organization supported by voluntary contributions of associations of manufacturers and individual manufacturers for the purpose of obtaining facts about industrial conditions as they exist in this country. It was founded in 1916 and now includes thirty organizations with a total of 50,000 manufacturing concerns employing over 7,000,000 men and women. Its fundamental purpose is to promote the public welfare by bringing together the collective experiences of those engaged in industry, by studying industrial and economic conditions and by disseminating well-considered views thereon, as its contribution to the solution of the problems of industry.

Its method of attaining this object is to make impartial investigations, co-operating with individuals, associations and agencies of the Government; to aid in securing, on the basis of established facts, joint deliberation of manufacturers in the United States; to secure, analyze and disseminate information concerning industrial problems; to promote friendly relations between employees and employers for the benefit of both and the community, and to make the results of its research and experience available to Government agencies when legislation is being formulated.

It is decidedly to its credit that the Conference Board does not advise employers what to do. It simply places facts before them with analysis and the valuation of these facts and leaves the decision entirely to the parties involved. It is only in this way that the Board can retain its standing as an unbiased body. Its primary function is to collect information, and to be sure that the information that it does collect is authentic.

Several associations of manufacturers in the metal trades are supporters of the Conference Board, as are also a number of individual concerns. The Board has published thirty-seven research reports and eighteen special reports besides a weekly Industrial News Survey. A few of the titles which impress even the casual reader at once are: War Time Changes in the Cost of Living, Hours of Work as Related to Output and Health of Workers in the Metal Manufacturing Industries, Works Councils in the United States, Practical Experience with Profit Sharing in Industrial Establishments, Practical Experience with the Work Week of Forty-eight Hours or Less, Cost of Health Service in Industry, Should Trade Unions and Employers' Associations Be Made Legally Responsible, The Closed Union Shop versus the Open Shop, Their Social and Economic Value Compared.

Copies of reports and a number of others are for sale to non-members of the Conference Board. Manufacturers who are interested can obtain information from the managing director, Magnus W. Alexander, 10 East Thirty-ninth street, New York City.

ART MUSEUM AND THE METAL TRADES

An interesting article, by R. F. Bach, in a bulletin which was distributed by the Metropolitan Museum of Art, New York City, points out the relation between the museum and the art metal trades.

Three years ago, it is stated, the museum appointed an Associate in Industrial Arts whose duties were to make resources of the museum accessible to these trades. The Associate works through the producers of art objects and through the journals which reach those producers. Great success has also already been achieved among dealers and sales people through the Museum Study Hours for Practical Workers, conducted by Grace Cornell. These aids, together with co-operation between the selling organizations and the manufacturers should give excellent results in educating the public to the value of good design.

The excellence of the results of this work are evident in the exhibitions of industrial arts held at the museum. Designers of advertising have made great use of the facilities of the museum and a great number of requests for criticism on designs is received.

Much excellent work has been done by co-operation between the museum and commercial enterprises. There is no reason why our manufactured products should not be beautiful as well as useful, and the museum stands ready to help to the limit of its capacity to make them so.

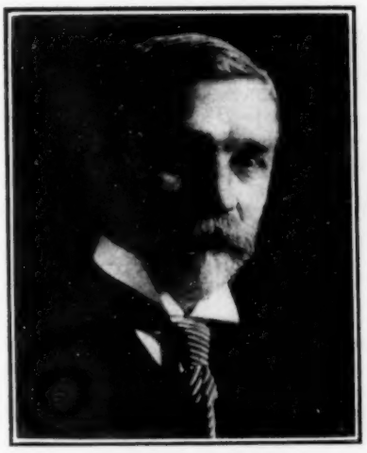
NICKEL INVESTIGATION

A decidedly commendable step has been taken by the American Electro Platers' Society in appointing a committee to work in conjunction with the Bureau of Standards upon researches on nickel deposition. The A. E. S. is well represented by the committee, which consists of William Delage, Joseph Haas, Jr., and S. E. Hedden.

The plating industry will look with considerable interest for the results of the co-operation between these two bodies.

JOSEPH WILLIAM RICHARDS

In the death of Joseph W. Richards, which was noted in THE METAL INDUSTRY for November, the metallurgical world has suffered a heavy loss. He was known internationally, and always in demand to pass judgment or to advise. But it is not only of his technical attainments that we wish to speak. They are too well known to need further description.



Latest Photograph of
JOSEPH WILLIAM RICHARDS

According to a communication from his son, William Richards, it is probably not generally known that Dr. Richards brought about a number of improvements for men who work in the mills. In one of his last conversations he mentioned that in his capacity of consulting engineer he had often dropped suggestions to managements that were of great value to the health, the general safety and comfort of the workmen, and that the knowledge of this service was to him a great comfort.

As a member of the Naval Consulting Board his work was so intense that his health was affected. He considered himself honored to be a member of the Board, although many would say that he gave as much as he received.

He was interested not only in his own specialty, metallurgy, but in other sciences, mineralogy, crystallography, and also in the arts. He did not neglect culture, having a sympathetic interest in music, art, literature, and language.

During the past few years he strove to formulate a philosophy of life from his experiences with physical and psychological phenomena, and in the words of his own son "Was becoming more and more that type of scientist who sees with the imagination beyond the immediate data. A searcher throughout life in all fields, it was father's great victory over Death that he not only found himself, but had finally learned of his place within the Creator's great world. A scientist then died a believer, after years of traveling, doubting and searching. I think that puts Joseph W. Richard's life quite beyond the ordinary scientists in significance."

NEW BOOK

Financial Engineering by Goldman, published by John Wiley & Sons, New York. Size 5½ x 8½—271 pages. Price $3.50 payable in advance. For sale by THE METAL INDUSTRY.

This is a most interesting book on a subject which is taken into consideration all too seldom by metallurgists and metallurgical engineers. It is a comprehensive study of engineering from the viewpoint of costs and values. Beginning with the simplest terms, such as profit, value, fixed charges, etc., which are understood by almost everyone, but which are much more clearly defined here than almost anywhere else, it goes on to cost segregation, under which are included such divisions as, interest and rents, depreciation and appreciation, obsolescence, natural and operating life, and maintenance. These two chapters are more or less introductory giving the background.

The next chapter explains the fundamental financial calculations, working out formulae, and showing the applications by means of practical problems, of such terms as equity, depreciation rate, vestance, etc. It opens up a field, which to the average metallurgist or metallurgical engineer are very seldom in evidence, but of which he should know more.

Mr. Goldman goes on to describe in detail, unit cost determination, the determination of size of system for best financial efficiency and the determination of type and size of units.

From the title of the book, it is evident that engineering is viewed from an entirely different light than ordinarily applied. After all, it is an acknowledged fact that no engineering project or industrial plant can be successful if it is a financial failure. Unfortunately, in the past too little stress has been laid on the financial aspects as compared with the technical. This work is valuable not only to the industrial engineer, and to the cost expert, but to the engineer of any type who wishes to broaden his outlook and to see his problem from another very important angle.

GOVERNMENT PUBLICATIONS

Secondary Metals in 1920.—By J. P. Dunlop, United States Geological Survey, Washington, D. C.

Cobalt, Molybdenum, Nickel, Tantalum, Titanium, Tungsten, Radium, Uranium and Vanadium in 1919.—By Frank L. Hess, United States Geological Survey, Washington, D. C.

CORRESPONDENCE AND DISCUSSION

Although we cordially invite criticisms and expressions of opinion in these columns, THE METAL INDUSTRY assumes no responsibility for statements made therein.

Electric Vs. Crucible Furnace

To the Editor of THE METAL INDUSTRY:

We note that in past issues that there has been some argument on the different fuels for melting non-ferrous metals.

Not long ago one of our men worked up the enclosed data sheets with a startling result. You will note that under are average conditions electricity would have to be sold for six-tenths of one cent. per K.W.H. in order to compare favorably with fuel oil.

We are simply sending this as we thought it might be of interest to you.

WAYNE OIL TANK & PUMP COMPANY.
Fort Wayne, Ind. By S. D. RICKARD,
November 3, 1921. Engineering Sales Manager.

Comparative Costs of Oil and Electricity for Brass Melting

Brass starts to melt at..... 1,800 degrees Fahr.
Temperature of cold brass..... 60 degrees Fahr.

Temperature raised ..... 1,740 degrees Fahr.

THEORETICAL EFFICIENCY

The **specific heat** of brass is 0.094, so $1,740 \times .094 = 163.56$ B. T. U. necessary to bring this metal to melting point. The **latent heat** of brass is 47.13, and this plus $163.56 = 210.69$ B. T. U. necessary to melt 1 lb. brass. Therefore, $210.69 \times 100 = 21,069$ B. T. U. required to melt 100 lbs. ordinary brass mixtures, based on 100 per cent. efficiency.

ACTUAL PRACTICE

Oil Fired Furnace.—100 lbs. of brass can be melted with 1½ gallons of fuel oil in a Wayne melting furnace, and as this amount of fuel contains 216,000 B. T. U., we find the efficiency of the oil fired furnace to be **21,069 x 100** or **9.7 per cent. efficient.**

216,000

Electric Furnace.—Assuming 20 K. W. H. electricity necessary to melt 100 lbs. brass and as 1 K. W. H. = 3,412 B. T. U., a total of 68,240 B. T. U. are required. Therefore the electric furnace is actually **21,069 x 100** or **30.9 per cent efficient.**

68,240

FUEL COSTS

Oil Furnace.—Fuel oil is now selling in tank car quantities, delivered, for .03½c. per gallon (.04c. in tank truck lots), and as 1½ gallons fuel oil will melt 100 pounds brass in a Wayne furnace, then **1½ x .03½c. = .05¼c. cost of all oil per 100 lbs. metal.**

Electric Furnace.—Electricity for power use costs from .02c. to .04c. per K. W. H. regardless of whether a factory buys it from central station or generates its own current, and in actual foundry practice 20 K. W. H. is a conservative figure, in melting 100 lbs. brass, so **20 x .02½c. = 50c. cost of electricity per 100 lbs. metal.**

SHRINKAGE LOSS

Oil Furnace.—The metal loss in melting depends largely upon the human element and the mixture being melted, but aside from spillage, etc., 3½ per cent. loss in yellow brass should be the maximum shrinkage in an oil fired furnace. In red mixtures or straight copper, the loss is much less, but assuming the maximum of 3½ per cent., and with metal at 12c. per lb. in scrap form, **the total loss in oil fired furnace is 42c. per 100 lbs. metal.**

Electric Furnace.—Shrinkage in the electric furnace is lower, but proportionate to the mixture as in the case of oil furnace; on yellow brass 1½ per cent. loss is assumed, and the difference between electric and oil furnaces averages 2 per cent. in favor of electricity regardless of the mixture; therefore, **the loss by shrinkage in electric furnace should not exceed 18c. per 100 lbs. metal.**

LABOR AND MISCELLANEOUS COSTS

The oil fired furnace may be charged during the melting period without interrupting the heat, and no skilled labor is required, while the electric furnace is not so readily accessible. In some foundries, a man is required to watch the electric furnace lest it develop a defect which should interrupt production. When metal "freezes" in this type of appliance it is no small task to remedy the trouble.

Water Cooling.—Some electric furnaces employ a water circulating jacket which involves an item of cost not usually taken into consideration.

Ladle Heating.—The electric furnace requires the use of a ladle for transferring the molten metal to the moulds, and often the oil or gas consumed in heating ladles would go a long way toward the actual melting of the metal if applied to a melting furnace.

SUMMARY OF OPERATING COSTS

Even the average jobbing foundry will melt six heats per day with a No. 60 crucible furnace, or five heats with a No. 70 size, which is equal to 1,000 lbs. of metal per day, or about 300,000 lbs. (150 tons) per year, and the following figures are based on the comparative fuel and operating costs of melting 100 lbs. of metal in both oil and electric furnaces, considering such items as **fuel, shrinkage, upkeep and labor.**

COST PER 100 LBS. METAL MELTED

	Fuel	Shrinkage	Labor	Upkeep	Total
ELECTRIC FURNACE.	.50	.18	.12	.20	$1.00
OIL FURNACE.....	.05¼	.42	.10	.12¾	.70

SAVING PER 100 LBS. IN FAVOR OF OIL..... $0.30 or 30%

Note.—"Upkeep" includes crucibles, linings and repairs for oil furnace and repairs, electrodes, linings, water for cooling, fuel for ladle heating, etc., on electric furnace.

Therefore, in the average foundry, melting 150 tons of brass per year, the total costs for melting with electricity and oil would be:

ELECTRICITY, at $1 per 100 lbs.....	$3,000
OIL at 70 cents per 100 lbs.....	2,100
ANNUAL SAVING IN FAVOR OF OIL.....	$900 or 30 %

Note.—This annual saving would buy oil supply for six years.

COST OF EQUIPMENT

A complete Wayne Fuel Oil Burning System, including furnace, oil storage tank, motor, blower, oil pump, pipe, fittings and all labor of installation can be placed in operation for less than $1,500, while electric furnace, transformers, wiring and other necessary apparatus for equipping the average foundry will be approximately three times as much; therefore:

ELECTRIC EQUIPMENT TO MELT 300,000 LBS. BRASS PER YEAR COSTS.....	$4,500.00
OIL EQUIPMENT TO MELT 300,000 LBS. BRASS PER YEAR COSTS.....	1,450.00
DIFFERENCE IN COST OF INITIAL INVESTMENTS	$3,050.00
PLUS 7% INTEREST.....	213.50
INITIAL SAVING IN FAVOR OIL FURNACE.....	$3,263.50

SUMMARY

Electricity must not cost more than **six-tenths of one cent (.006) per K. W. H.** in order to approach the operating economy of the **oil fired furnace,** as shown in the following:

Under "Summary of Operating Costs" it will be noted in the electric furnace that one-half, or 50c., of the melting cost ($1 per hundred pounds), is charged to fuel, and the remaining 50c. covers shrinkage, labor and the various classified items comprising upkeep, so $1,500 of the $3,000 estimated cost of melting 150 tons of brass per year goes for current.

The total cost of melting this tonnage with oil is $2,100,

and deducting the annual interest on the difference between the original investments in the two systems, or $213.50, this leaves a fixed limit of $1,886.50 for the total operating cost of an electric installation if it is to favorably compare with oil. Assuming that $1,500 must be set aside for the above mentioned items of labor, shrinkage, upkeep, etc., this leaves but $386.50 for current, and as 60,000 K. W. H. are necessary, the unit rate per K. W. H. could not exceed .006.

The original saving on the initial investment, in addition to the annual saving in operating cost, is convincing proof that fuel oil for metal melting is preferable to electricity, and will appeal to the plant manager having the interest of the stockholders at heart. Many factories installed electric furnaces during and immediately subsequent to the war rather than pay excess profit taxes on large balances, but with normal conditions again prevailing, the economy of the oil fired furnace cannot be denied.

To the Editor of the METAL INDUSTRY:

The summary of Mr. N. K. B. Patch's experience with electric melting equipment, presented at the last general meeting of the American Electro-chemical Society and reported in your November issue, cannot fail to be of the greatest interest to all practical foundrymen and non-ferrous metallurgists.

Although Mr. Patch does not favor us with any figures as to power and fuel costs and consumption, yet the outstanding fact is that Mr. Patch, on the basis of several years actual experience, obviously in a modern well-managed plant, has found that electric melting with the types of equipment he mentions offers no decided **advantage or economy** over crucible or fuel fired reverberatory furnace equipment; and this, it should be noted, in a locality where electric power can be obtained at lowest cost; probably lower than anywhere else in the United States.

Mr. Patch very properly draws attention to the fallacy of the idea that electric furnaces are fool-proof and can therefore be operated by anyone; an idea, which unfortunately, seems to have been fathered and spread broadcast by the highly colored literature of some electric furnace manufacturers.

It is gratifying to the writer to observe that Mr. Patch confirms many contentions, made in your columns from time to time, on this question. Among them might be mentioned the exploding of the pet theory of many electric furnace enthusiasts that low zinc losses are an inherent feature of electric furnaces; Mr. Patch also confirms the contention that electric power used in such furnaces costs much more than ordinary forms of fuel for the same purpose unless such fuel is grossly wasted, and last, but not least, he supports the contention that the very low initial investment required for crucible furnaces as compared with that required for electric installations, places the latter at a very great disadvantage.

Mr. Patch's experience should carry much weight with those who are considering the installation of metal melting equipment, and he has performed an invaluable service in presenting his findings to the trade.

THOMAS H. A. EASTICK.

Montreal, Canada, November 21, 1921.

LIFE OF GEORGE WESTINGHOUSE

To the Editor of THE METAL INDUSTRY:

To the memory of few other men, if any, do the engineers of America owe so great a debt of gratitude as to that of George Westinghouse, whose inventions and achievements have not only benefited mankind, but have made possible the enterprises in which so many of our number are now engaged.

The underlying motive for publishing a biographic series of great American Engineers is to inspire others; and in presenting this beautiful volume we need hardly say that there will be no financial profit. The prices specified ($6 for half morocco and $3.50 for cloth) represent absolute cost to the Society; and that cost includes neither overhead expenses nor remuneration to the author.

Since the subscription edition must be limited to the number of advance orders received, it probably represents the only opportunity to secure "The Life of George Westinghouse" in such beautiful and enduring form. To the unusual merit of the work itself will thus be added the charm of possessing a volume which is exceedingly rare, and which will become increasingly valuable with each succeeding year.

Many engineers will try in vain to secure a copy of this volume when the limited edition is published. They can make sure of a copy in only one way—by filling out and sending in order form from the American Society of Mechanical Engineers promptly.

CALVIN W. RICE,
New York, November 1, 1921. Secretary, A. S. M. E.

GOLD SWORD FOR GENERAL DIAZ

To the Editor of THE METAL INDUSTRY:

None of the generals who are entertained during the Legion Convention received a more enthusiastic reception than General Armando Diaz, the brave Italian fighter from far-off Italy. The Italians of the city, in their enthusiastic way, have made elaborate preparations for a welcome he will never forget.

GOLD SWORD FOR GENERAL DIAZ

The entertainment centered around the presentment of a gold sword, which symbolized the love and affection the Italians of Kansas City hold for the general. This gold sword was made in Kansas City by the Cady & Olmstead Jewelry Company, the same firm that designed and made the sword presented to General John J. Pershing.

The design of the scabbard shows solid gold engrossed with olive leaves, signifying as in the ages past that his great deeds have given to Italy not only victory, but also the gift of peace, that can be secured by victory alone, which carries with it national wealth and domestic plenty in the days to come.

His initials, "A. D." are engraved and encrusted with eighty diamonds, and all set in platinum. On the grip or hilt of the sword an appropriate presentation engraving is shown. The flags of Italy and the United States are crossed in the center of the scabbard, signifying the bond of comented friendship between the two nations, with the heart of America beneath, typifying not only the location of Kansas City in the center of the United States, but showing the love and affection held by his friends in Kansas City for his glorious and valued service, rendered in the pursuit of the World War. The American Legion button is shown in the center of the scabbard, recalling the occasion of his visit to our shores. Under his monogram are the words, "Trento, Triests," the two provinces added to Italy in the war. The general's military record will be engraved on the lower portion of the scabbard, intertwined with the olive leaves.

The steel blade is profusely etched with emblems of the World War. On the end of the scabbard is crossed the Missourian flag with the American Legion. The Seal of Kansas City is engraved in relief below the flaming torch, which typifies the date of his birth under the shadow of Vesuvius fifty-eight years ago. The Italian coat-of-arms is shown in the center of the scabbard, the wings engraved typify the "Winged Victory," recalling the victories gained by his characteristic master strokes during his military career. Diamonds, sapphires are used profusely. In the end of the hilt is set a great Hungarian Opal, of wonderful luster and color. The ancient Roman emblem of the faces are shown, signifying the original "United we stand, divided we fall," of the United States, and also that in friendship, America and Italy combine strength for the preservation of World Peace in the future.

CADY & OLMSTEAD JEWELRY COMPANY.

Kansas City, Mo., November 14, 1921.

SHOP PROBLEMS

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE

BLISTERED DEPOSITS

Q.—We have been plating die cast in gold, silver and nickel for years, and have not encountered any trouble until recently. When the work comes from the bath it appears to be all right, but after it has been exposed to the air from 6 to 12 hours it becomes a mass of very small blisters. It appears to be a gas formation in the metal that works out through the plate, causing the spotting out. We have tried about everything we could think of and hear of, and I wonder if you could enlighten us any on the matter.

A.—It is our opinion that your trouble is due to hydrogen occlusion. This trouble may be caused by improper cleansing. That is using too strong a cleanser, which darkens the metal excessively, enabling the hydrogen to readily occlude in the metal. Or the trouble may be due to excessive acidity of the nickel solution.

The addition of 2 ounces sodium citrate and ½-ounce nickel chloride will overcome the trouble. These amounts should be added per gallon of solution. It is advisable to maintain neutrality by keeping nickel oxide suspended in the nickel solution in cheese cloth bags, especially during the summer time. Agitation of the solution also helps to overcome hydrogen occlusion.—C. H. P. Problem, 3,013.

CASTING WORM GEARS

1. A bronze worm gear is giving us considerable trouble in securing sound castings. This piece is one of heavy section. This is necessary as the heaviest strain comes near the base of the threads. The metal on the surface usually appears sound, but on machining shows segregation and sponginess, which is worse near the center than close to the surface. We are sending, under separate cover, a piece broken from one of these worms, for your examination.

2. Test bars, cast at the same time as the worms, .925 in. in diameter and turned to .800 in. in diameter give the following properties:

Tensile strength	24,000 to 30,000 lbs. per sq. in.
Yield point	17,000 to 20,000 lbs. per sq. in.
Elongation in 2 in.	9% to 14%
Reduction of area	7.5% to 15%

The fracture is fine grained, fairly uniform and free from sponginess. Test bars turned down from pieces cast 3 in. in diameter, have low properties and show much the same defects as the worms.

3. We wish to obtain sound castings with the following properties:

Tensile strength	25,000 lbs.
Yield point	18,000 lbs.
Elongation	10%
Reduction of area	10%

4. We have cast these worms both in blank and skeleton form, and we encounter the same trouble, segregation and sponginess in both cases. They are poured on end in sand molds from metal of approximately the following composition: Copper 85%, tin 10%, lead 2%, zinc 3%. We have gated some from the top, and some from the bottom, but seem to get the same flaws in the castings either way. The melting is done in an oil fired Hawley (Schwarz) Down Draft Furnace. The charge consists mainly of ingot of the above composition, with a small percentage of return metal such as gates and risers.

5. We have tried various fluxes, such as glass, borax and Radioclarite, the latter a mixture consisting of cryolite, salammoniac, silica, etc., without improving the castings.

6. We have poured the metal at temperatures varying from 1,700° F. to 2,500° F. without overcoming our trouble, although the metal seems to be more sound at the higher temperatures.

7. Will you kindly tell us, after examining the sample we are sending, what, in your opinion, is the cause of the unsoundness of these castings, whether it is wrong practice, use of unsuitable material, or some other cause. Would it be of any advantage to use an iron or steel core in the mold?

When a heavy sand casting is made from the mixture that you mention, segregation of the tin is likely to occur. The slow cooling due to sand mold also results in a large grain size which is distinctly evident in the test period. Sometimes the broken halves of a test piece will give a cross section that is almost square instead of round and the elongated portions will be lumpy and angular.

The best method of procedure for you to use is to make a hardener of 20 parts of copper and 80 parts of tin, pouring same into small ingots.

Melt the copper and bring to a high heat, then add the amount of hardener necessary to give the required tin content. Finally add the lead and zinc, stirring thoroughly. A good cover to use when melting in the Schwartz furnace would be lime and fluorspar.

Instead of using a sand mold you are advised to use a split cast iron mold about 11 inches in diameter and 6 feet high, with walls at least 4 inches thick, so as to give the ingot a good chilling. The two halves of the mold can be fitted with suitable lugs or hooks so they can be conveniently assembled. They should be given a very light coating of lard oil before pouring and the metal poured at a moderate temperature.

You will find that the blanks you cut from an ingot cast as above described, will be much superior to those cast in sand.—J. L. J. Problem, 3,014.

CEMENT FOR KNIFE HANDLES

Q.—We would be obliged if you could provide us with a formula for a cold cement for securing hollow metal or celluloid handles on steel blades. We understand that one of the most common cements in use has for a base litharge and glycerine, but we have been unable to mix this so as to obtain the desired degree of hardness.

A.—Litharge and glycerine cement is used to a great extent for such purposes as you outline, but the cement must be properly prepared and it is necessary that a pure glycerine be used.

The litharge should not be mixed with the glycerine indiscriminately, but glycerine should be placed in a receptacle, and enough litharge should be sprinkled over the surface of the glycerine to give the proper consistency for your purpose.

Another combination you might try is composed as follows:

Silicate of Soda	6	parts
Glycerine	1	"
Powdered Red Lead	3½	"
Sifted Coal Ashes	10	"

A recent patent, No. 1,388,011, a copy of which you can obtain from the Patent Office, Washington, D. C., for ten cents, gives for a metallic cement, oxide of iron, oxide of zinc, litharge and comminuted aluminum mixed with water glass to the desired consistency.—C. H. P. Problem, 3,015.

COPPER-LEAD-MOLYBDENUM ALLOY

Q.—What is your opinion about the value of a bearing metal containing 50 parts copper, 50 parts lead and 2 parts molybdenite stirred in?

A.—Molybdenite is a mineral consisting of molybdeum disulphide and its formula is MoS_2, so that it contains about 40% sulphur. When heated in the air molybdenite is oxidized with the evolution of sulphur dioxide. The specific gravity of the mineral is 4.70.

When two parts of molybdenite concentrate are stirred into a mixture of 50 parts of copper and 50 parts lead, the sulphur evolved by the heat of the molten metal is no doubt partly absorbed by the alloy and the rest of it burns to sulphur dioxide gas and passes off, being thus non-effective.

If the sulphur of the molybdenite is given off gradually, this may be a rather effective way of adding sulphur to a 50 copper,

50 lead mixture. However, when compared with the use of galena, stibnite, etc., molybdenite would seem to be a rather expensive ore to use. Many foundries make use of stick sulphur or brimstone in order to combine copper and lead. Nickel and phosphorus are advocated by others.

In the opinion of the writer more depends upon the skill and experience of the melter than in the exact formula used. Perhaps the nickel and phosphorus alloys give better results in unskilled hands than sulphur or the various sulphides. However, extremely good results are obtained by the use of sulphur alone or the sulphides.

The alloy of 50 copper, 50 lead is highly esteemed for packing rings, but as a bearing metal its use is rather limited. Its Brinell hardness is about 28.0 or no higher than a good lead base babbitt. Another drawback is the fact that the turnings of this alloy oxidize so readily when melted that they can only be run down with great loss unless very carefully handled.

If some foundryman can devise a method of casting a thin lining of the 50 copper, 50 lead alloy in a cast iron shell, he will have a good thing.

The sample of broken ingot and the small machined bushing were carefully examined and found to be fairly well alloyed. Spots of uncombined lead were visible but these areas were not extensive and the castings ought to give good service in bearings, where the pressures were not excessive and there was no heavy belt pull.—J. L. J. Problem. 3,016.

GOLD RECOVERY

Q.—How can I recover gold from old cyanide solutions?

A.—You state that you are familiar with the use of zinc and hydrochloric acid, but want a more practical method.

The only other method that can be termed practical is to deposit the gold out of the solution by the electro method as in plating. This can be readily done by using an insoluble anode such as carbon and a cathode that is readily soluble, such as zinc, which could be coated with a thin film of copper or brass from solutions of cyanides of copper or brass.

The old gold solution should be maintained at 100 Fahr. during the time that the gold is being deposited out of the solution.

Occasionally add a small amount of sodium cyanide, but avoid an excess, to keep electrical action in a short time at 2 to 3 volts, and a fairly high current in amperes. The gold will all be deposited upon the cathode. You can prove by test when the solution is entirely depleted of gold.

The amount of water in the solution should be maintained.

After the gold is all completely deposited upon the zinc cathode, the zinc can be dissolved in hydrochloric acid and pure gold will remain, which can be filtered from the acid, washed thoroughly, and re-used in solutions or melted down to bullion.—C. H. P. Problem, 3,017.

HIGH LEAD MIX.

Q.—How can we make a casting of copper 60, lead 37½ and tin 2½?

A.—Nickel is generally used to hold the lead. Melt the copper, using a little salt as flux. When thoroughly melted, and at a heat of approximately 1900° F., add about .05 ground ferro manganese. Then add 1½% nickel, after which add the lead gradually, stirring between each addition. When the lead is completely melted, add four ounces of soda ash to each hundred pounds of metal. If no nickel is allowed, melt the copper and add 0.25 sulphur. Stir well, and add the lead. When all the lead is in, stir in 0.75 more sulphur, stir and add 0.25 soda ash per one hundred pounds of metal. The nickel will give the best results. Gate with a thin, wide gate into the casting and a long runner on the cope to swim the metal.—W. J. R. Problem, 3,018.

HIGH COPPER ALUMINUM ALLOY

Q.—Will you please give me a flux that I can use on aluminum alloys. My castings have pin-holes. The mixture is 81-19.

A.—Aluminum alloys should not be overheated in the furnace. This is more important than a flux. Pin holes in aluminum castings are caused by pouring at too high a temperature into the mold. The more rapidly that the metal settles after it gets into the mold, the better it is for the casting. Sand, which is too damp, will cause the molten aluminum to decompose the water and combine with oxygen, and absorb hydrogen and cause pin holes. A small amount of magnesium may help clean the metal. Phosphorus is detrimental. Chloride of zinc is the best flux; add a piece of about the size of a walnut just before pouring, and be sure to get a good alloy. I would suggest that you make an alloy consisting of 50 per cent. copper and 50 per cent. aluminum, by melting the copper in a crucible and pouring the molten copper over the aluminum in a separate pot or crucible. Stir well, and pour in ingots for casting. Melt eight pounds of alloy, and add 42 of aluminum and pour at about 1,350 degrees Fahr., and you will not have any further trouble.—W. J. R. Problem, 3,019.

GREASE FOR GROUND PLUGS

Q.—Can you give us a formula or the source of supply for a grease to be used on ground plug work? The requirements are for a consistency as nearly uniform as possible, so that it will not harden in the cold weather and bind the plug nor become too soft in temperature up to 180 degrees. It is desirable that the grease be non-corrosive when used on brass cocks.

A.—Use the following formula for grease for use on cocks.

Beef Tallow	25
Lard Oil	25
Albany Cup Grease	10
Beeswax	35

Melt or render the beef tallow, pour and strain. Add the beeswax, lard oil and Albany grease. Cook over a slow fire and thoroughly mix for fifteen minutes.

This can be used on ground key work, for gas, water and steam goods, and makes the plugs turn smoothly and freely, as it has body and is non-corrosive.—P. W. B. Problem, 3,020.

PANTAGRAPH TROLLEYS

Q.—I have some pantagraphs for electric trains to make of aluminum and they must meet the test of at least 18,000 lbs. tensile strength and must conform to the following analysis:

Aluminum	not under	94
Copper	" over	6
Manganese	" "	3

A.—I wish to state that there is no trouble in meeting the specifications required for aluminum pantagraphs, with a tensile strength of 18,000 and a composition of not less than 94% aluminum, and not over 6% copper, and 3% magnesium.

An alloy of 45% copper, 5% ferro manganese, and 50% aluminum is first made by melting 45% copper and 5% ferro-manganese. Add the aluminum a little at a time before the copper gets too hot; stir, well, and pour into ingots. Use as follows: 88% aluminum, to which add 12% hardener. Do not overheat the metal and pour at approximately 1350 degrees Fahr. Use chloride of zinc as flux.—W. J. R. Problem, 3,021.

SPANGLES ON TIN

Q.—What causes spangles on tinned articles?

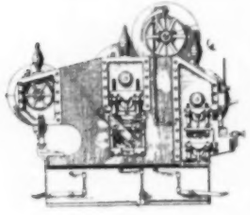
A.—In the production of spangles on galvanized sheet iron, slow cooling and the use of a pure grade of zinc are essential. The impurities to be avoided are those that would cause a quick setting of the zinc and thus make the spangles or crystals very small. Quick setting of a zinc or tin coating on iron does not absolutely prevent the formation of crystals, but it makes them so small that they are not conspicuous, being microscopically small. Hence a bright surface results. Avoiding a high temperature will shorten the time of cooling and hence electric heating of tinning pots with automatic temperature control is desirable.

If spangles occur on your tinned articles after observing all the usual precautions of quick cooling and the avoidance of unusually high temperatures, some impurity in the tin may be suspected. Some of the pig tin produced in China is known to be rather high in bismuth. Whether bismuth or some other impurity might be present in sufficient amount to lower the melting point of the tin and delay setting of the metal very appreciably may be doubted, but an analysis of the tin you are using should be made as you would then no longer be in doubt as to the quality of the tin used, and the elimination of this possible source of the trouble might lead at once to the real cause and its elimination.—J. C. J. Problem, 3,022.

PATENTS

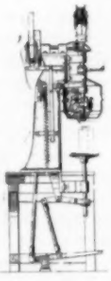
A REVIEW OF CURRENT PATENTS OF INTEREST

1,389,880. September 6, 1921. **Combined Punching, Shearing, Section-Cutter, Bar-Cutter, and Coping and Notching Machine.** Hans B. Kraut, of Chicago, Illinois.



The invention relates to improvements in metal cutting machines and refers more specifically to a novel combination machine embracing a number of mechanisms for variously cutting or working metals, such as punching, shearing, section cutting, bar cutting, and coping and notching mechanisms. The invention is herein shown as embodying a machine which combines in its structure punching and shearing mechanisms located at opposite ends of the machine frame, section and bar cutter mechanisms located intermediate the ends of the frame, and a coping and notching mechanism located at one end (the shearing end, as herein shown) of the frame.

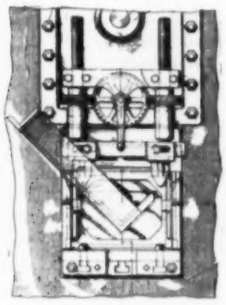
1,389,894. September 6, 1921. **Soldering-Machine.** Thomas Myhrum, of Chicago, Illinois, assignor to Continental Can Company, Inc., of Syracuse, N. Y.



The invention relates to new and useful improvements in soldering machines, and more particularly to a machine wherein a soldering iron is mounted for rotation for applying solder to circularly disposed seams.

An object of the invention is to provide a machine of the above type wherein the soldering iron is mounted on a rotating head and located at one side of the axis of the head, and means is also mounted on said head for heating iron and supplying solder thereto.

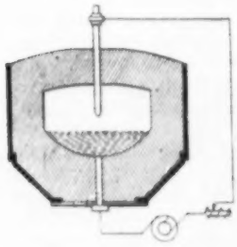
1,389,881. September 6, 1921. **Metal-Section Cutter.** Hans B. Kraut.



This invention relates to improvements in machines for shearing or cutting rolled metal shapes or sections, and refers more particularly to a novel attachment for supporting the movable and fixed blades of the section cutter, and also to means for supporting the work for miter cutting.

Among the objects of the invention is to provide a novel attachment for supporting the cutting blades on the operating slide and a fixed portion of the frame, respectively, so constructed as to permit quick detachment and replacement of the blades.

1,379,942. May 31, 1921. **Electric Furnace and Method of Operating Same.** Frederick T. Snyder, of Oak Park, Ill., assignor to Industrial Electric Furnace Company, of Chicago, Ill., a corporation of Indiana.



This invention relates to improvements in electric furnaces. The objects of this invention are: to provide an improved method of automatically regulating the electric power supply of an electric furnace so as to maintain a uniform temperature in the furnace; to prolong the life of the furnace parts; and to provide a novel construction by means of which the above mentioned method of regulation may be carried out more advantageously than with existing types of furnaces.

1,391,010. September 20, 1921. **Apparatus for the Manufacture of Metal Tubes by the Self-Hooping Process.** Eugéne Schneider, of Paris, France, assignor to Schneider & Cie., Paris, France.

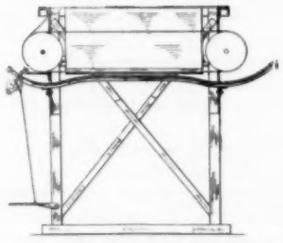
This application is a division of a former application filed March 31, 1919, Serial No. 286,501, for an improved process and apparatus for the manufacture of metal tubes of great strength by the "self-hooping" method, which consists in subjecting the interior of the tubes to charges of fluid under very high pressure to stress and to condense the metal to shape and to strengthen the same.

1,391,009. September 20, 1921. **Process and Apparatus for the Manufacture of Metal Tubes by the Self-Hooping Process.** Eugéne Schneider, of Paris, France, assignor to Schneider Cie., of Paris, France.

This invention has for its object to provide an improved process and apparatus for the manufacture of metal tubes of great strength by the "self-hooping" process.

This invention is applicable to the known process wherein the "self-hooping" is effected by the pressure of a liquid acting between the inner wall of the tube to be shaped, and a resistant core ("self-hooping" mandrel) inserted in the said tube.

1,390,990. September 20, 1921. **Apparatus for Removing Excess Spelter from Hot Galvanized Articles.** Charles G. Ericson, of Toronto, Ont., Canada.

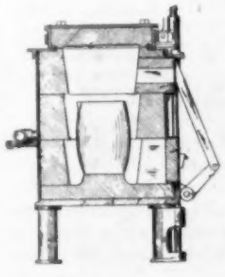


This invention relates to apparatus for removing excess spelter from hot galvanized articles, and particularly adapted for the treatment of rods or bolts, and the object is to devise a machine for this purpose operating by centrifugal action, which can be quickly installed at small initial cost, and which will not in any way injure or distort the objects treated.

1,392,780. October 4, 1921. **Method of Pickling Metal Articles.** Henry S. Marsh and Ralf S. Cochran, of Youngstown, Ohio.

This invention relates to the pickling of metallic articles, and, as the inventors have developed it, it particularly concerns the pickling of sheet steel in the course of fabrication. As will be apparent, the invention in its broader aspects is applicable to pickling metallic articles generally, whatever be the shape or substance. The invention consists in improvements in method of pickling in continuous operation.

1,392,317. October 4, 1921. **Brass Furnace.** Alfred Fisher, of Chicago, Ill.



This invention relates to an improved type of a metal furnace adapted for melting brass, bronze, aluminum and other metals in a crucible which is removably mounted within a lined shell or casing which is removable as a whole from the furnace frame to permit a new shell or casing to be mounted in place.

EQUIPMENT

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST

NEW ELECTRIC HOIST

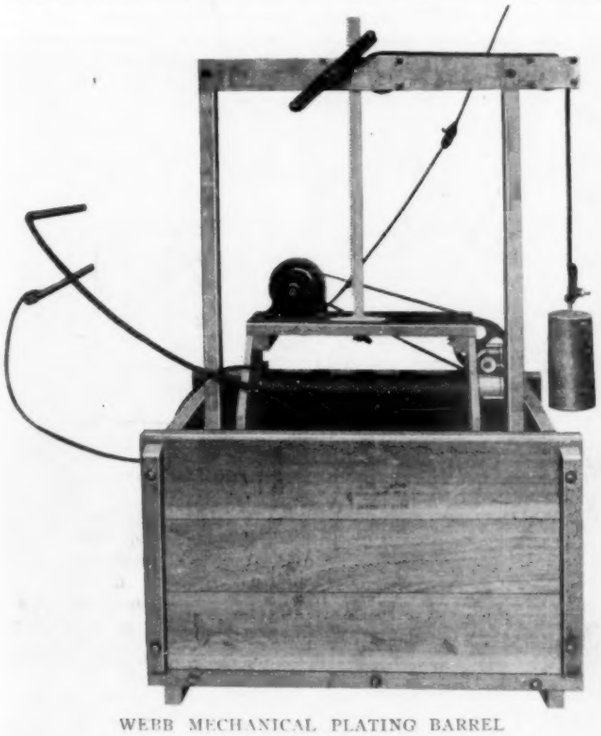
To provide an Electric Hoist for every load-moving job, small as well as large, is the purpose of the Liftabout, a small general utility hoist recently announced by the Shepard Electric Crane and Hoist Company, Montour Falls, N. Y. It is claimed that it can be applied to advantage in lifting almost anything and carrying it almost any place. Heretofore many have been under the impression that an electric hoist could be used only for the big, heavy rehandling jobs and that it was not adaptable to the smaller ones. The Liftabout, it is stated, is particularly designed and suited to usual and unusual lifting jobs encountered in factories, mills, and warehouses; that wherever hand labor is now employed on any job of lifting, carrying and putting down the Liftabout affords a new and far more economical means for doing the work.

LIFTABOUT IN ACTION

The Liftabout can be operated wherever electric current is available and is easily installed on the side of a building, on the ceiling of a basement, or in any point that will bear the weight of a load. One man can run a Liftabout.

NEW MECHANICAL PLATING MACHINE

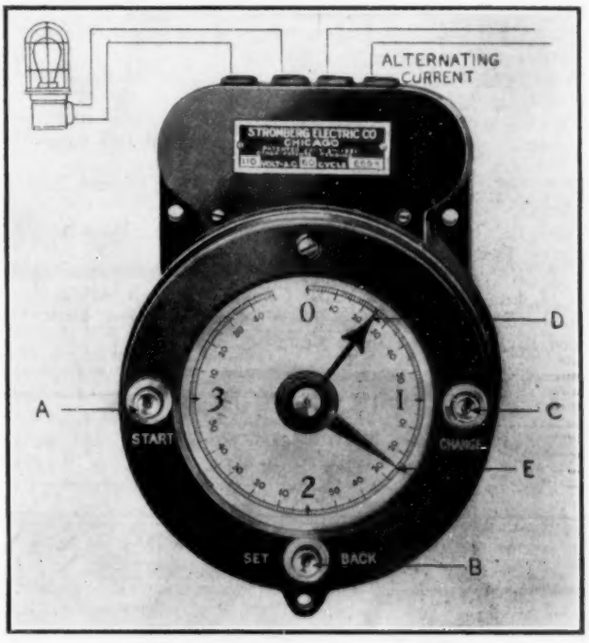
A new mechanical plating machine, manufactured by Harry Webb, 6172 12th street, Detroit, Mich., which is claimed to be an improvement over the barrel type machine, consists of a conveyor belt 24" wide for revolving the work, a cage built around the conveyor belt to raise and lower into solution by means of a gear and a rack with a counter weight to balance the load. No countershaft is required, as it is motor driven. It is said to be very easy to operate as by raising the cage out of the solution and raising the board the cathode connection is on. The work falls out into a hopper. It is also claimed that a heavier deposit of metal is obtained in less time as one anode is placed directly over the work being plated with no obstruction between it and the work. There are no metal parts on the cage to use up the current, so that a heavier deposit of metal can be formed in the shortest length of time, with less current.



WEBB MECHANICAL PLATING BARREL

NEW TIMING AND SIGNALING INSTRUMENT

This instrument has been developed to meet the demand for an accurate and thoroughly dependable means of automatically operating a signal at the end of a predetermined time, to announce the completion of a process or operation. It has a very broad field of application. There is no other device on the market operating similarly or covering this field.



TIMING AND SIGNALING INSTRUMENT

"E" is the "setting hand" which is set to show the period of time of the process. In the illustration the instrument is set for a process of one minute and twenty-five seconds. (The setting hand is enamelled red in the actual instruments.)

"D" is the indicating hand" which starts from the point at which the instrument has been set and travels to zero. In the illustration the "indicating hand" has started at one minute and twenty-five seconds and has travelled one minute, and indicates that twenty-five more seconds must elapse before the process is completed.

"C" is the button for setting the instrument for any length of process desired. The pushing in and then turning of the button "C" sets the instrument for a new length of process. The turning of this button also causes the "setting hand" "E" to move, and by observing the location of the "setting hand" the instrument can be quickly set for any new length of process.

The indicating hand then remains stationary at the starting point, until the operator is ready to start a fresh process, at which time he presses the button "A," which releases the indicating hand and causes it immediately to begin to travel towards zero, in correct relation to time. It is made by the Stromberg Electric Company, Chicago, Ill.

ASSOCIATIONS AND SOCIETIES

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS

AMERICAN FOUNDRYMEN'S ASSOCIATION

Following the announcement appearing in the Associated Bulletin for November and in the trade press, that the next Convention and Exhibit will be held in Cleveland the week of April 24th, the secretary has received many letters asking when floor plans and application blanks will be ready.

For the information of all he advises that floor plans showing the layout of exhibit space in the Arena and Exhibition Hall, together with application blanks and general information, will be mailed to all former exhibitors, following the meeting of the Convention and Exhibits Committee, which will be held in Cleveland Tuesday, December 6th.

An exceptionally strong advisory committee has been organized by the American Foundrymen's Association and the Engineering Division of the National Research Council to consider the problems encountered by the foundrymen in their use of molding sand and furnace refractories. On this committee are representatives from the various branches of the foundry industry, the U. S. Bureau of Standards, the U. S. Bureau of Mines, the U. S. Geological Survey, the Canadian Department of Mines, the American Ceramic Society, and noted metallurgists, geologists and ceramists from commercial organizations and universities.

At an organization meeting held in the office of the National Research Council, in New York, October 28, an executive committee of seven members, representative of the various interests, was selected. Some of those asked to serve on this committee are:

R. J. Anderson, U. S. Bureau of Mines Experiment Station, Pittsburgh, Pa.

Jesse L. Jones, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

C. P. Karr, U. S. Bureau of Standards, Washington, D. C.

H. M. Lane, The H. M. Lane Company, Detroit, Mich.

Homer F. Staley, Metal & Themit Company, New York.

Fred L. Wolf, Ohio Brass Company, Mansfield, O.

NEW YORK BRANCH, A. E. S.

The regular meetings were held Oct. 14th and Oct. 28th. at the Broadway Central Hotel, New York. President J. A. Stremel. arranged a Banquet Committee to make preparations for the 13th Annual Banquet. Committee consists of J. E. Sterling, H. Flanagan, Thos Stretch, Thos. Haddow, Wm. Voss, Ben Popper, A. Grinham, A. Havens, Wm. Fisher and John Burke. The publicity committee arranged a theatre party and supper at the Hippodrome Saturday, Oct. 29th, which was carried out in great shape.

The following problems were discussed at the meeting: French bronze with the use of lacquers and enamels; the use of sodium salts; bronze on brass or copper plated articles.

The November meetings were held November 9th and 25th at the Broadway Central Hotel, New York. President Stremel presided. Two applications were received for associate members and were referred to the committee for investigation.

The main topics under discussion were the connecting of shunts, the best wire to use for rheostats, the breaking of steel springs by pickling, spotting out on brass plated steel and other metals, brightmer for cyanide copper without interfering with oxidizing and balancing of free cyanide in brass solutions.

PHILADELPHIA BRANCH, A. E. S.

On Saturday evening, November 19th, this branch of the American Electro Platers' Society held a very successful banquet at the Lorraine Hotel. The Committee had expected an attendance of not more than fifty, but when the guests had assembled, they found that the attendance was eighty-five or ninety, far surpassing their expectations.

Owing to a serious illness, Mr. John B. Fay, Chairman of the Committee, was unable to attend, but the balance of the Committee handled the situation in a very able manner, and the dinner was thoroughly enjoyed.

After the dinner, Mr. George Gehling, President of the Philadelphia Branch, and toastmaster of the banquet, introduced Mr. Philip Uhl, Supreme President of the society, Mr. J. E. Sterling, Supreme Secretary, and Dr. Lukens of the University of Pennsylvania, all of whom offered brief suggestions to the Society and what should be done for it in the future.

After the speeches the evening was spent in dancing and entertainment.

PHILADELPHIA BRANCH BANQUET, NOVEMBER 19, 1921

LIGHTING FIXTURE DEALERS

From January 30th, 1922, to February 4th, the National Council of Lighting Fixture Manufacturers, the Dealers' Society of America and the Illuminating Glassware Guild will hold their Third Annual Lighting Fixture Market and their Second Joint Convention at the Milwaukee Auditorium.

In addition to the above-mentioned events there is to be a "Better Lighting Week" to be held during the Convention. Demonstrations of better lighting methods for homes, offices and industrial plants, together with free surveys and reports on improvements possible in existing lighting installations—those and many other features will show the people of Milwaukee the road to more efficient and artistic illuminating methods.

Last, but by no means least in its spectacular attractive appeal to the public, is the "Pageant of Light," a wonderful reconstruction of the progress of lighting fixtures and methods from the flaring torch of the cave-man to the equipment of today. Information can be obtained from Charles Hofrichter, 231 Gordon Square Bldg., Detroit Ave. & W. 65th St., Cleveland, O.

Personals

The Chancellor and Trustees of the University of Pittsburgh announce the appointment of **Edward Ray Weidlein** as director of the Mellon Institute of Industrial Research.

R. L. Warburton, sales engineer, for a number of years connected with the Celite Products Company, has become identified with the Quigley Furnace Specialties Company, 26 Cortland street, New York, in the capacity of sales engineer.

The Taylor Society announces the election of **Mr. Henry R. Towne,** chairman of the Board of the Yale and Towne Manufacturing Company, as Honorary President of the Society.

H. B. Farrand, who was formerly connected with the York (Penna.) plant of the American Chain Company, has accepted a new position as foreman of the plating, polishing, tumbling, lacquering and japanning departments of the General Electric Co., Philadelphia, Pa.

A. H. Brothers, who was formerly connected with the J. B. Ford Company, Philadelphia, and K. F. Griffiths Company, New York City, has accepted a position as salesman with John B. Fay and Company, Philadelphia, Pa., distributors of electro plating equipment and supplies.

Arthur Lucian Walker, professor of metallurgy in the Schools of Mines, Engineering and Chemistry of Columbia University, has been elected a member of the Board of Engineering Foundation. He succeeds the late Dr. Joseph W. Richards.

Professor Walker is internationally known particularly in the field of copper metallurgy, as an inventor and a teacher.

W. H. Bassett has been elected chairman, and **G. C. Stone,** secretary, of a committee on zinc and zinc ores, recently organized by the American Society for Testing Materials to work in co-operation with the American Zinc Institute.

W. H. Bassett has been nominated for director of the American Institute of Mining and Metallurgical Engineers.

A Research Committee to co-operate with the Bureau of Standards has been appointed by Philip Uhl, president of the American Electroplaters Society. The committee consisted of **S. E. Hedden,** Aspinwall, Pa., **Joseph Haas, Jr.,** New York, and **William Delage,** Waterbury, Conn.

Deaths

JOHN H. CARR

John H. Carr, founder and president of the Union Metal Works, of Chelsea, Mass., died on November 3. Mr. Carr was born in Cambridge, Mass., on April 11, 1863. He received his education in the Cambridge Schools. He held responsible positions in Rome, N. Y., and with one or two well-known Boston concerns, prior to going into business for himself.

In 1901 he went into business under the name of John H. Carr and Company, which was later incorporated as the Union Metal Works.

He was a member of the Chamber of Commerce of the United States, the Boston Chamber of Commerce, The Everett Board of Trade, and the Everett Lodge of Elks, and was a director of the Everett National Bank. For years he has been a well-known figure in the plumbing supply trade of New England.

He had been ailing for a few years with an irritating form of neuritis and rheumatism, but always retained his keen mind and ability to direct and run the Union Metal Works and any other affairs in which he was interested. His death, practically instantaneous, caused by a cerebral hemorrhage, was a great shock and entirely unexpected, as he had an exceptional constitution for a man of his years and had actively remained the head of his business up to the very date of his death.

Besides his wife, Mrs. Nellie Foley Carr, to whom he was married in 1891, he leaves a daughter and two sons.

The sons James H. Carr and Francis J. Carr, will carry on the Union Metal Works, with the same policies and principles that have made the company a factor in the plumbing supply industry of New England.

HENRY S. REGESTER

Henry S. Regester, Sr., who was for years secretary of the J. Regester and Sons Company, famous for half a century for the manufacture of church bells, died recently at the home of his son, Henry S. Regester, Jr., 3915 Forest Park avenue, Baltimore.

Mr. Regester was born in Baltimore, Md., October 17, 1852, of Welsh and Quaker ancestry. He received his early education at the Newton Academy, at that time one of the largest private schools in the city. He finished his education at the Maryland Agricultural College. He then entered his father's business in partnership with his brothers, under the firm name of J. Regester and Sons, conducting a brass foundry at Holliday and Saratoga streets, and an iron foundry at Bay View Junction, Md. The brass foundry was noted for the large number of church bells and chimes, in addition to general plumbing supplies. About fifteen years ago, the iron foundry at Bay View Junction, was sold to the Central Foundry Company, and the brass foundry was incorporated under the name of J. Regester and Sons Company, of which Mr. Regester was secretary, until the dissolution of the business. He then became agent in this territory for John F. Maneely of Philadelphia, handling the famous Byers Pipe of Pittsburgh. He held this position until his death on October 31, 1921. He was paralyzed on October 22, and died at noon, October 31, at his son's residence. He is survived by his widow, Kate S. Regester, and two sons, Henry S., Jr. of Baltimore, and Ramsay G. of Lancaster, Pa.

HARRY W. WAITE

Harry Webster Waite, for 22 years associated with Waite, Ranlet and Company, Boston, Mass., dealers in metals died at his home in Brookline, Mass., on November 3, aged 67 years. He was born in California, but spent practically all his life in New England, where he was well known in the metals trade, being in that business for 35 years.

FRANK ZELLER

Frank Zeller, foundry foreman, died at his residence in Pomona, Cal., October 22, 1921, after an illness of three years. He had been foreman for the Jarecki Manufacturing Company in Erie, Pa., until his health gave way. He was widely known as an expert foundryman. He wrote several articles for THE METAL INDUSTRY, among which was the booklet on Founder's Mixtures.

TRADE NEWS

BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS

WATERBURY, CONN.

DECEMBER 1, 1921.

The remark of a Waterbury factory employe, to the effect that Saturday, November 26, was the first Saturday that he had gone to his daily work in over a year, lends support to the growing belief that business has begun an upward trend of decided strength. Further questioning of this employe brought the statement that production, in the immediate vicinity of his department, was beginning to show a steady improvement, as evidenced in the fact that a seven-day working schedule was again being resumed. Added to this is the statement, within the week, of the head of the local associated charities orfganization. For the first time in many long months, he said, he had been able to supply work cards to all those who applied for them. And the local Chamber of Commerce, which has also instituted an employment bureau, reports that it is placing from 10 to 12 hands a day. The demand, however, is still said to be chiefly for unskilled labor.

The placing of men at the various trades and positions in the factories is a new undertaking for the Chamber of Commerce, and is the result, in this city, of several ineffectual attempts to organize an efficient independent bureau to cope with the unemployment situation which threatened at one time, in Waterbury as well as elsewhere, to undermine the economic stability of industrials.

Reports of business conditions among the local producing factories range from "encouraging" to "good."

According to an authoritative source, a rumor is being persistently circulated that one of the lake groups of mines is to become associated with the American Brass Company. It is also said that a similar report concerning Anaconda Copper has been heard frequently of late, but this has been denied. Nevertheless the announcement of such an arrangement would create no surprise, it is said, for it is generally accepted that sooner or later the producers must also control fabrication as well as distribution. This is qualified to a certain extent by specifying that manufacturing near the source of supply is the crux, and while this is said to be contrary to the opinions and expressions of mining men, it is given much weight by other community leaders in the mining regions.

The recent lecture in this city of Dr. Eugene Lyman Fiske, president of the Life Extension Institute, accentutes the forward steps that have been taking by the American Pin Company, of Oakville, in factory hygiene and personal health. Officials of that company firmly believe that a noticeably strengthened factory morale is due, to a large extent, to its recently (that is to say within a year or two) installed program of periodic physical examinations for the foremen of the factory. The examinations are not compulsory, and are free to those who take them. To date, two incipient cases of serious maladies have been successfully treated—cases that would not have been otherwise discovered until perhaps too late, had not the health program been instituted by the company. Officials of the company hope eventually to extend its free examination offer to every person in its employ.

H. G. N.

TORRINGTON, CONN.

DECEMBER 1, 1921.

Conditions continue to improve in metal industries in Torrington. All the plants are working on increased schedules and additional workers are being taken on from time to time. The Union Hardware, American Brass Company, and Excelsior Needle plants are all on 55-hour schedules; the Fitzgerald Manufacturing and Hendey Machine plants, 45 hours; the Torrington Manufacturing and Turner & Seymour, 24 hours; and the Standard, Progressive Manufacturing and National Sweeper plants on schedules varying from week to week. The Hotchkiss Brothers Company is working over time.

So far as the employment situation is concerned, THE METAL INDUSTRY correspondent is informed that no skilled workers are out of employment, though many of course are working on short time. From the same source, the correspondent learns that approximately 1,000 laborers are idle, except insofar as they are able to secure work outside of the shops.

The general situation, however, is considerably more encouraging that it was two months ago and the general opinion seems to be that the "worst is over."

Work was started during the past month on a big addition to the plant of the **Union Hardware Company**. The addition will be 300 feet long and 60 feet wide. One section, 100 x 60 feet, will be two-stories high and so constructed that it may be used for factory purposes. The other section, 200 x 60 feet, will be one-story high and will be used for a storehouse. The construction work is being done by employes of the company.

Louis Lamoin, 55, for 27 years an employe of the Union Hardware Company, died November 7. Death was due to heart trouble.

Charles L. Green has resigned his position at the **Hendey Machine Company** and returned to his former home in Providence, R. I. Mr. Green was with the Hendey company for about six years, his duties being practically those of superintendent. He was in charge of the plant during the period of the world war.

The clubhouse of the A. B. C. Club near Millerton, N. Y., was completely destroyed by fire with all its contents during the past month. The cause of the fire is not known. The A. B. C. Club is composed of employes of the Torrington Branch of the American Brass Company.

Announcement is made of the marriage in Waterbury on November 19 of Willard Girvin, technical supervisor at the Torrington Branch of the American Brass Company, and Miss Mary Coon of Waterbury, formerly of Red Hook, N. Y. Mr. and Mrs. Girvin are residing in Torrington.

J. H. T.

NEW BRITAIN, CONN.

DECEMBER 1, 1921.

Conditions in the metal manufacturing industries in this city show material improvement over what they were during the last quarter, and indications are that the coming winter months will find business steadily improving in practically all lines of builders' hardware manufacturing.

Where three months ago practically every local concern was steadily laying off men, reducing wages and curtailing working hours, today the opposite is true with the exception of wages. These have been pared down to pre-war rates and it is evident that the days of high wages in local factories are a thing of the past. In view of the radical cuts in pay it might be expected that there would develop some little labor trouble, threats of strikes etc., but this is not so. Local manufacturers have always succeeded in keeping New Britain an "open shop" community and there is not a single metal trade union here of sufficient strength. even to threaten a strike, let alone call one. In many of the factories additional help are being employed and in some departments the number of men employed is again at normal, being the same as that before the slump of last summer. The same holds true of working hours. Although during the summer months business was apparently at such a low ebb that working hours were pared down to a low minimum, now they are experiencing a come-back. Every concern is working longer hours and in some departments they are on the old time schedule of 55 hours per week. The **P. & F. Corbin**, branch of the **American Hardware Corporation**, is for the

most part on a 55 hour basis, though the **Cabinet Lock Company** has not yet reached that in all branches. **Landers, Frary & Clark** are operating on an added schedule and the same holds true of most of the other plants, including the **North & Judd Manufacturing Company,** the **Stanley Works,** the **Stanley Rule & Level Company** and others. But while others show signs of stimulated business, the **New Britain Machine Company** continues to lag far in the rear. The tractor business has not succeeded and the general machine making industry has suffered deplorably. H. R. J.

ROCHESTER, N. Y.

DECEMBER 1, 1921.

After experiencing several months of acute depression, the like of what has not been felt in Rochester in many years, business in manufacturing circles has shown a slight improvement during the month that is closing. With the advent of the holiday season it is not expected that the improvement will be so marked, but there is every indication that with the beginning of the new year the big industries of this city will realize that the "corner" has been turned and that a gradual return to more prosperous conditions is on the way.

In Rochester much depends upon the passage of the Fordney tariff bill or legislation along similar lines, as many of its industries do considerable exporting in addition to meeting foreign competition at home. In each of the abovementioned industries, it is reported that business is better and the working forces have received additions.

The demand for copper, brass, tin and aluminum in the various industries is inclined to be quiet at this time, although brass and tin products have been more generally used in the larger plants in the past month than at any time since January last. Purchasing agents report that inroads have been made in the supply of sheet brass and rods. Lead and zinc are quiet.

Several of the plating plants report more activity, and better business conditions have been noted in the **Van Bergh Silver-Plating Works** in Main street west. G. B. E.

INDIANAPOLIS, IND.

DECEMBER 1, 1921.

Announcement of plans of the **Speedway Engineering Company** for expansion in the manufacture of valve heads, parts and accessories for automobiles was made recently by Rufus E. Welborn, a director of the concern, following filing of articles of incorporation with the secretary of state. The concern was incorporated for $100,000.

The **Globe Stove and Range** factory, Kokomo, Ind., has fired its cupolas in anticipation of beginning operations soon to take care of the increased fall market for their products, according to information given out from the office of Superintendent James Trayers. It will be at least two weeks before the full force of 350 men will again be employed, it was stated.

The **Concord Foundry Company** at Elkhart, Ind., has filed a notice with the secretary of state showing the dissolution of its corporation.

The position of shop superintendent at the **Brass Foundry & Machine Shop,** Fort Wayne, Ind., has been left vacant by the resignation of **Frank T. Benoy,** who has held the position for over 30 years, and resigned to go to California where he will live. In 1887, Mr. Benoy commenced work as a foreman in the boiler shop and structural department of the Fort Wayne Foundry & Machine Co. At the end of two years he started working for the Bass Foundry & Machine Company as superintendent which position he has held since, with the exception of three and a half years, when he served as chairman of the board of works.

The **M. Martinoff Company,** manufacturers of brass and copper devices, having a factory at Louisville, Ky., will establish a factory soon at Anderson, Ind., and will occupy about 6,000 square feet of floor space in the R. G. W. Foundry of that city. Common labor will be secured in Anderson and the company plans to transfer about 25 families of skilled employes from the Louisville plant.

The **Anderson Foundry and Machine Works** at Anderson, Ind., is reported busy by president W. N. Durbin. The factory has been working a night shift in its testing department. A number of orders came in recently and the plant now has a large booking of orders piled up. All departments of the factory are running fairly full. E. B.

TRENTON, N. J.

DECEMBER 1, 1921.

Conditions continue to show improvement in the plants here with more orders coming in. Manufacturers now believe that the worst is over and that by cold weather the plants will start on full time.

The **Frank Miller Company,** with offices in the American Mechanic Building, Trenton, has been incorporated with $250,000 capital to deal in steel, iron and metals, both old and new. Alexander Budson is the agent in charge.

The **Mercer Motors Company,** Trenton, reports business picking up considerably, new dealers and distributing agencies being established lately. The company has just been reorganized by the private sale of $2,000,000 in 7 per cent. four year notes and $500,000 in twenty year first mortgage bonds. The corporation's balance sheet shows current assets of $2,265,767 and current liabilities of only $334,107.

The **Hulsander Engraving Company** will shortly begin the erection of its new plant on Lincoln avenue. The building will be three stories, 40 by 60 feet, brick, concrete and steel to cost $40,000.

Sheet metal firms from a dozen South Jersey towns held a meeting recently at Millville and discussed business and trade topics. A meeting of metal dealers will be held shortly for the purpose of organizing a state association.

The **American Type Foundry Company,** has been operating a plant at Belvidere for the past two years, has shut down indefinitely, throwing many skilled mechanics out of employment. A month ago the company gave notice of a shutdown and since that time had been finishing work on hand. Market conditions and accumulated stock on hand caused the shutdown.

The federal government and the **Keystone Watch Case Company** have reach an agreement by which two anti-trust suits pending in the Supreme Court will be dropped. The government won a partial victory in an anti-trust suit against the company in a lower federal court in Philadelphia. The Keystone Watch Case Company has a plant at Riverside, N. J.

Traf-o-Lite Sales Company of New Jersey, Newark, N. J., has been incorporated with $100,000 capital to deal in automobile devices.

An examination of the books of the **American Copper Products Corporation,** of Elizabeth, N. J., is sought in an application filed in the New Jersey Supreme Court at Trenton by William J. MacMillan, a stockholder of Roselle, N. J. George E. Matthias and Franklin K. Jerome, of Seymour, Conn., are president and vice-president, respectively, of the copper concern. The complainant, MacMillan, alleges that certain moneys have been spent by the president and vice-president for promotion purposes, the result of which may be ascertained only through an examination of the records.

The **Bugbee Battery Company,** of Trenton, N. J., has been incorporated for the purpose of manufacturing storage batteries, etc., under patent rights. The company will erect a plant shortly. The incorporators are Alvin W. Bugbee and Newton A. K. Bugbee, of Trenton, N. J., and Robert H. Steele, of Milburn, N. J.

The **New Jersey Zinc Company** reports net earnings for the three months ending September 30 of $763,053, equal to $1.81 a share, compared with $583,927, or $1.39 a share in the preceding quarter and $1,711,873, or $4.07 a share in the corresponding period of 1920.

The **American Type Foundry Company,** of Jersey City, N. J., will erect a branch factory at El Mora, N. J., William Kelly, of Westfield, N. J., a director of the concern, says work on the proposed new plant will be started soon.

K. M. & S. Stamping Company, of Newark, N. J., has been incorporated at Trenton with $100,000 capital to deal in all kinds of metals.

One building was destroyed and another partly burned recently when flames visited the plant of the **American Copper Products Company,** South Front street, Elizabeth, N. J. The buildings were used for the storing of copper scales.

The metal polish plant of **Aaron Schnur,** Trenton, recently gutted by flames has not yet been rebuilt and it is now probable that the owner will not continue in the business.

The **M. L. Copper Welding Works,** Newark, N. J., has been organized. Meyer L. Levy, 125 Somerset street, at head of concern.

The **Kolb Sheet Metal Works,** 30 Orange street, Newark, N. J., has been organized to manufacture fans, blowers, etc. Norman L. Kolb, of 56 Crawford street, Newark, president.

The **National Metals Products Company,** of Passaic, N. J., has been incorporated at Trenton with $50,000 capital to manufacture metal goods.

The **Mulberry Metal Stamping Works,** of 352 Mulberry street, Newark, N. J., has been organized to manufacture metal products. C. A. L.

BALTIMORE, MD.

DECEMBER 1, 1921.

The **Metaloy Company,** 1728 Mullikin street, has been incorporated by John L. Brown, William B. Rearick and Louis S. Houghton, to manufacture metal and metal alloy products.

The canning industry in Baltimore has been greatly handicapped during the past two months by the shortage of raw material, but inquiries in hand indicate a fine volume of business in the Spring of 1922.

The **Maryland Culvert and Metal Company,** William M. Baker, president, 1301 Munsey Building, has under construction a 28 by 36 foot addition to its plant on Ridgely street.

The **Curran Motor Radiator Company, Inc.,** with a factory at 1702-08 Light street, has increased its capitalization to $500,000, and Elmer Altreith has been made president, to succeed C. J. Conway, resigned. The company has purchased a site for a new factory building 40 by 180 feet on Hanover street, near the bridge. It will have a brick front and glass walls—a daylight structure—with asbestos roof. Building will commence immediately. The plant will give employment to about 50 persons.

The **Hercule Lock Guard Company,** 509 Lobe Building, William C. Jones, president, has organized for the manufacture and sale of a patented lock, the lock being manufactured by contract. W. J. L.

DETROIT, MICH.

DECEMBER 1, 1921.

Indications at present seem to point to more or less depression in the brass, copper and aluminum field for the next two or three months. There is but little doing in any line outside the automobile industry, which now seems to be bolstering up almost every line of trade. This, however, is drawing rapidly to an end and when that is reached nothing seems to be in sight except to wait for the general spring revival which may start somewhere along in February.

None of the big plants seem to have been buying to any extent for some time. Almost everyone seems to be following out Henry Ford's example by reducing inventories as low as possible and using cash where it will make its quickest turnover. Collections are slow, some running as far back as last June and July. Money is hard to obtain and when once it is pried loose, it must be obtained by a big bonus. Banks are tight, and lending, where lending is possible, is out among some of the favored few, who happen to be so fortunate as to have a surplus.

Notwithstanding that the depression has extended over so many months, no unexpected, or surprising, failures have taken place.

Almost everyone who has discussed the situation is confident that a decided change for the better will manifest itself along about February and that from then on things will grow better with no following slump.

"We are getting out of the woods," seems to be a general expression. Then again great faith is pinned on the disarmament conference. If this disagreeable question is once settled, and taxation cut, there will be more available cash for manufacturing purposes. Furthermore there will be more confidence in overseas markets which also will help a lot here in America. F. J. H.

CLEVELAND, OHIO

DECEMBER 1, 1921.

Turn of the year is going to bring a marked change for the better in the automotive and general manufacturing industries in Northern Ohio. This is not only the belief of leaders in big business here, but they are laying plans already looking to the carrying out of this idea. During October and November more construction of manufacturing buildings was either planned or started than during any other two months of the year. With building as a basic industry here, and more commercial and housing construction going on, less unemployment is noted as the year draws to a close, and this means bigger spending, and consequently added outlet for all products, leaders in different lines of production point out.

In this connection the plans of the Ninth Garage Company, just announced, call for significant development that will mean much to the manufacturers in all lines in this section. The present building of the company, still a comparatively new structure, will be remodeled to carry four additional stories, making an eight floor building in total, wherein a permanent exposition will be conducted for manufacturers of Cleveland and vicinity.

As fast as exposition space is provided the following exhibits will be installed: Machinery and manufacturers' equipment, electrical devices, office equipment and supplies, and such other items as may be added as manufacturers here and nearby realize the importance of this form of publicity for their products. The upper floors of the addition to the building will be used for convention purposes and an auditorium for demonstrations, lectures and the like.

Plans for funding the company's outstanding indebtedness, and to increase its working capital, through the issuance of $750,000 first mortgage bonds, are being laid before stockholders of the **Cleveland Brass and Copper Mills Company.** The move, explains President **H. C. Osborn,** follows the greatly enlarged plant which was necessary for governmental requirements during the war, and which converted a considerable portion of the working capital. During the last three years need for additional working capital was felt severely, but at the same time the strength of the enterprise is amply demonstrated in the fact that there was no shutdown.

A sign of progress for the immediate future is shown in the acquisition of additional property to that already held by the **Sterling Manufacturing Company,** electrical appliance specialists. The parcel is in the new light manufacturing district on upper Prospect avenue. Plans for its use may be announced later by the Sterling.

Labor's view of the improved industrial situation, and particularly in relation to the metal industries, is illustrated in the report made to the mayor's unemployment conference by **Henry W. Raisse,** of the metal trades division of the Cleveland Federation of Labor. He asserted that a goodly portion of the 90 per cent of unemployed pattern makers in the metal industries are going back to work weekly.

C. C. C.

LOUISVILLE, KY.

DECEMBER 1, 1921.

Business is showing just a little improvement in the casting shops, but with the copper and brass sheet metal working trades things continue very quiet, a number of the plants being down entirely, or merely operating with the most limited crews. Reports from the East indicate that demand

for brass goods is picking up, which would indicate that it would begin to be felt down here probably after the first of the year. Louisville was busy when the East was dull.

The local coppersmiths could be doing a land auction business if they would accept all the steam kettle and coil work that is offered them, in connection with the large number of illicit stills that are in operation. It is reported that a few coppersmiths who are not employed just now, have been working up a bit of stuff for retailers and concerns who are willing to take chances in getting into trouble with the Government.

One of the prominent coppersmiths reported that he had steadily refused to have anything to do with any still work. A short time ago a man, who he knew by sight, and knew to be a Federal officer, came in and bought twenty feet of copper tube. He then asked that it be bent into a coil. The coppersmith refused. The Government man wanted to know why, and the coppersmith told him that he wouldn't make that tube into a coil for even the United States Government, without a written and signed order, coming through legitimate channels, as it was against the law, and he was not taking any chances on Federal prison. The customer then turned down the tube, and said he would look elsewhere. He didn't have far to look at that. However, if this Federal officer gets in trouble over running a still of his own, whoever made the coil for him will get into trouble also. It isn't anything unusual either for Federal officers to try to get evidence by such methods.

Hines & Ritchey report that general business in the trade is quiet, that there is not much new work coming.

Independent Brass Foundry reports that the shop has been busy for thirty days on general work, including a lot of bronze antique lighting fixtures and specialties.

Vendome Copper & Brass Works state that they are doing practically nothing in the copper and brass shop, that the aluminum plant is down entirely, and that the only thing running is the sheet metal and boiler department, which is being kept fairly busy.

Ahlers & Gregoire are getting a little business all the time on candy kettles, and special work of one sort of another, but are not rushed by any means.

The **Standard Sanitary Manufacturing Company** manufacturers of general plumbers supplies, is operating regular night shifts in order to keep ahead of demand on plumbing goods, and build up stocks, which have been greatly reduced by the heavy demand this summer in connection with active building.

The **Laib Company** interests, which operate the **Columbia Sanitary Manufacturing Company,** manufacturers of enamel goods and plumbing supplies, are planning to enlarge the plant. A. W. W.

MONTREAL, CANADA

DECEMBER 1, 1921.

The general situation in the brass manufacturing plants for the past month is that of marking time. Prices have remained stationary and the small amount of business passing is about that same as the previous month. The larger brass foundries are following the methods pursued by the iron foundries and are only purchasing from hand to mouth.

All lines of scrap metals present the usual inactivity. There is but little improvement this year and it is altogether too risky to prophesy beyond that. The Eastern Townships Smelting and Refining Company has been incorporated under the laws of the Province of Quebec with a capitalization of $2,000,000. The company has options on some desirable sites in Sherbrooke and expects to have the plant in operation January 1. Arrangements have been made for the smelters to handle the output of several of the largest producing properties in this district, special attention being paid to copper and asbestos.

Keen competition is the rule for the different representatives to secure the contracts for the metal products that will enter into the construction of the new $3,000,000 Mount Royal Hotel, which is now under construction in this city. These contracts will be awarded in the near future. P. W. B.

BIRMINGHAM, ENGLAND

NOVEMBER 24, 1921.

The outlook for the non-ferrous industries has brightened. While a general revival of business is not yet in sight, improvement is more continuous. Orders from Australia for gas, steam and water fittings, the volume of which hitherto has been small and fluctuating, are now coming in more regularly and cable orders are now more frequent. Export business in small electrical fittings is also improving. Efforts by Australia to establish its own brass and other industries have been hindered by extravagant labor demands, while Japanese competition, which shortly after the Armistice seemed likely to be formidable, has become largely negligible owing to the unreliability of the goods supplied. Export business in lavatory and sanitary fittings has greatly improved, especially in Egypt, which for a year past has been practically a closed market to the brass founder. South America also is an improving customer for these and other metal goods. Cabinet brass founders, who have been the worst sufferers from trade depression, are now much better employed.

Distinct improvement in the non-ferrous metal trades generally, and particularly in the brass trade is shown by the decrease in the union unemployment lists.

A great hindrance to revival in manufacturing activity is the continuance of large disposals of machinery and tools by the Government. Makers of machine tools, among others, are on this account unable to get orders. Some firms, even with reduced staffs, are not working three days in a fortnight.

Silversmiths and electroplaters report better business, both home and export. India, Australia and New Zealand are ordering increasing quantities chiefly of small fancy goods. At home Christmas has brought a little improvement in demand, though not nearly to the extent usual in ordinary times. A few jewelry firms are fairly well employed, but generally the industry remains in a state of great depression. Aluminum foundries, lamp manufacturers and others which draw business from the motor industry are expecting to benefit by the success of the recent motor show in London, which has been followed by large orders to Midland firms. Makers of aluminum hollow-ware are suffering severely at home from German competition and are asking for protection under the Safeguarding of Industries Act.—H.

VERIFIED NEWS OF THE METAL INDUSTRY GATHERED FROM SCATTERED SOURCES

Richards and Company, who have absorbed the Eastern Metals Refining Company state that no decision has been made regarding the rebuilding of the latter's plant which was mostly destroyed by fire several weeks ago. The site, on Roland street in the Charleston district of Boston, is alongside the main freight yard of the Boston and Maine Railroad, with no street between it and the yard tracks. A temporary roof has been put over the portion of the building which was not fully destroyed, and some work in smelting and refining is being done there.

The **American Bosch Magneto Corporation,** Springfield, Mass., has completed the erection of a 10-story building at 17-19-21-23 West Sixtieth street, New York, of steel, stone and concrete. The company will occupy four floors for its automotive electrical sales and service station. This company operates a brass, bronze and aluminum foundry, brass machine shop, tool room, grinding room, stamping, tinning, plating and lacquering departments.

The **Lumen Bearing Company,** Buffalo and Youngstown, Ohio, has opened a branch office in Chicago to take care of business west of and including Michigan, with the exception of Detroit, and west of a line from Toledo through Columbus

to Cincinnati; and in Kentucky, Tennessee and Georgia. H. S. Huncke is the Western sales manager, with Henry Waters as associate salesman. The office is located at 15 North Jefferson street, Chicago.

Ellsworth M. Taylor, 149 Broadway, New York City, is prepared for consultation in foundry cost accounting and similar work, and has issued a circular letter to the members of the American Foundrymen's Association urging consideration of correct accounting methods.

The **Hoevel Manufacturing Corporation,** 154 Ogden avenue, Jersey City, N. J., controlled by L. O. Koven and Brother, announce the resignation of Mr. H. F. Hoevel as secretary and general manager, effective November 15, 1921. The sale of the Hoevel sandblasts will hereafter be in charge of J. M. Betton, well known as one of the pioneer makers of sandblast machinery.

A study of the heat treatment of cast non-ferrous alloy is to be made by the **United States Bureau of Mines** at the Pittsburgh, Pa., Experiment Station. It is proposed to study the annealing of cast non-ferrous alloys for the release of casting strains and the improvement of physical properties. The investigation, which will have special reference to aluminum, will be conducted under a cooperative agreement with a commercial firm. Work on the investigation will be under the supervision of R. J. Anderson, metallurgist of the Bureau of Mines.

The **Economy Machine Products Company,** Chicago, Ill., has moved to its new building, 5212-14 Lawrence avenue, Chicago, Ill., which is larger and gives them more room. They manufacture screw machine products, metal specialties, headless and safety set screws, and practical air brushes and sprayers.

The **Baum Dairy Appliance Company,** Natick, Mass., has been incorporated with a capital of $175,000, to manufacture dairy, surgical and hospital supplies, machines, dies, tools, etc. Ewald C. Baum, 19½ West Central street, is president, and Hallett E. Jones, 66 Walnut street, treasurer.

The **American Foundry Company,** Salisbury, N. C., recently established, is rushing work on a plant, where they will manufacture castings of all kinds, and rebuild machinery. They will operate a brass, bronze and aluminum foundry and will handle all kinds of new, second-hand and rebuilt iron and wood-working machinery, boilers, engines, etc. In addition to a complete foundry outfit with a cupola for about 3½ to 4 tons capacity, they will need two lathes, one 25" drill press, one 16" shaper, hack saws, pipe threading machines, motors, etc. They prefer to have this equipment second-hand, but it must be in A-1 condition. Thomas G. Shelton, High Point, N. C., is general manager.

Reed Brothers, Inc., 91 Drumm street, San Francisco, Cal., manufacturers of surgical instruments, etc., have plans under way for a new branch factory at Irvington, Cal., to cost about $100,000, with equipment. The first unit will be followed by later additions. They operate a brass machine shop, tool room, grinding room, spinning, stamping, brazing, soldering, plating and polishing departments.

The **Commercial Pattern and Manufacturing Company,** 1489 E. Fort street, Detroit, Mich., has been organized with a capital of $40,000 to manufacture metal patterns, brass and aluminum castings, etc., by Ernest J. and Leo J. Rousseau and Lynn C. Beadle. This company operates a brass, bronze and aluminum foundry, brass machine shop and tool room.

The **Metal Products Manufacturing Company,** 561 W. Lombard street, Portland, Oregon, has been incorporated with a capital of $100,000, and is now manufacturing a full line of cast aluminum cooking utensils, including steam cookers, on which they have patents pending. The company will also do a general aluminum foundry business. The officers of the company are: W. W. Lucius, president; F. M Wood, vice-president, and Geo. Curtis, secretary-treasurer. Temporary offices are being maintained at 110 Yeon Building. They are in the market for machinery, particularly specialties not available through local houses.

British Government's Big Scrap Deal*

The Government deal in brass scrap, which brought forth such strong protests from metal merchants throughout the country, was made the subject of questions in the House of Commons, in reply to which Mr. Young, the Financial Secretary of the Treasury, gave the authenic details which the trade had been for some weeks endeavoring to obtain. He stated that the sale embraced the whole of the stock in Great Britain and that only. The surplus stocks belonging to the British Government in other countries, he said, were comparatively small. The quantity of metal sold to the **British Metal Corporation, Limited,** was 150,000 tons and the price obtained £3,650,000. This represents an average of £24 6s 8d a ton.

In reply to questions as to the previous transactions with a Birmingham firm of metal merchants, **E. J. Smith & Company,** it was stated that the contracts made with this firm in June and July, 1920, were for 18,000 tons and 15,000 tons, respectively, those being the approximate amounts of brass then available for disposal. E. J. Smith & Company agreed to take further accumulations of brass, which it was then anticipated would be small. Owing to unforeseen circumstances, mainly the drastic reduction in the reserves of munitions and the bankruptcy of a contractor in Canada, who had purchased large stocks of surplus brass, the supplementary quantities which became available for disposal were approximately six times the original quantity purchased by E. J. Smith & Company. In view of this and the collapse in markets generally the uncompleted portion of the contract with this firm was cancelled on the basis of their surrendering to the Government the whole of their profits for the year 1920.

After full consideration, it was decided to utilize the organization set up by E. J. Smith & Company with a view to selling the remaining quantities of brass on a commission basis, the rates being 1 per cent. on sales and 5 per cent. for establishment charges. The 5 per cent. was divisible equally between the Government and the contractor. Prior to the re-sale, the firm had, in fact, sold on commission approximately 40,000 tons of brass. Mr. Young admitted that no advertisement was issued in respect of these disposals, but pleaded that the existence of these stocks was common knowledge in the trades interested. A number of firms did, in fact, approach the Disposal Board with a view to their purchase. The experience of the Disposal Board was that in selling large quantities of material better terms were obtainable by private treaty negotiations than by putting the stocks up to public tender. The amount of commission to be paid by E. J. Smith & Company in respect of the sale to the British Metal Corporation was for the present the subject of negotiation.

It was suggested by a member of the House of Commons that owing to recent large re-sales of Government stocks of non-ferrous scrap metal foreign manufacturers were able to compete on specially favorable terms, owing to the lower cost to them of raw material. Mr. Young did not admit this. He said that it would be open to British manufacturers, having regard to the cost of freight, to purchase on more favorable terms than their foreign competitors.

With regard to this last point, it is interesting to note that a German paper, the "Metallbörse," recently stated that both German and American interests are concerned in the deal. The British Metal Corporation, to whom the sale has nominally been made, and which was formed shortly after the Armistice, was understood to have for its object the protection of British interests against the operations of the German metal magnates and especially of the **Metallgesellschaft.**

Particulars of the sales to date of Government surplus property and raw material were issued this week by Sir Howard Frank, Chairman of the Disposal and Liquidation Commission. The total amount realized by the disposals, exclusive of those effected in overseas theatres, is approximately £600,000,000. Included in this total are 630,000 tons of ferrous and 200,000 tons of non-ferrous scrap.—H.

*See THE METAL INDUSTRY for November, 1921, p. 463.

WORK ON ALLOYS

The work on alloys being done by the Bureau of Mines was discussed at a meeting between bureau officials and the standing committee of the Institute of Metals Division. It was decided that the standing committee would meet twice a year in the future at the Bureau of Mines. Those who attended the meeting were H. Foster Bain, director, Bureau of Mines; W. M. Corse, Monel Metal Products Corporation; R. B. Moore, chief chemist, Bureau of Mines; William B. Price, Scovill Manufacturing Company; W. H. Bassett, American Brass Company; R. J. Anderson, Bureau of Mines; L. W. Olson, Ohio Brass Company; C. H. Bierbaum, Lumen Bearing Company; George C. Stone, New Jersey Zinc Company; W. R. Webster, Bridgeport Brass Company; H. W. Gillett, Bureau of Mines; DeCourcy Browne; Paul D. Merica, International Nickel Company; J. L. Jones, Westinghouse Electric & Manufacturing Company; John F. Thompson, International Nickel Company; William A. Cowan, National Lead Company; Andrew Stewart, Bureau of Mines; Dorsey A. Lyon, Bureau of Mines; E. L. Mack, Bureau of Mines.

TRADE PUBLICATIONS

Polishing and Electroplating Plant Equipment.—A remarkably complete and comprehensive catalogue issued by George W. Kyle & Company, Inc., Grand and Thompson streets, New York. It covers every phase of plating, polishing and finishing equipment and is filled with illustrations. It is a valuable catalogue for any plant using these supplies to have.

Plumbers' High Grade Brass Goods.—A catalogue issued by the E. Stebbins Manufacturing Company, 354 Birnie avenue, Springfield, Mass., illustrating their line of plumbers' brass goods, and giving the list price each instead of list price a dozen, which they claim is an innovation in the trade.

Research Narrative No. 20. Maleic and Fumaric Acids.—A folder issued by the Engineering Foundation, 29 West 39th street, New York City.

Mail Boxes.—A folder issued by the Elkhart Hardware Manufacturing Company, Elkhart, Ind., illustrating and describing their line of enameled letter boxes.

Portable Welding Outfit.—A small booklet issued by the Davis-Bournonville Company, Jersey City, N. J., illustrating and describing their garage and small machine shop welding torch and carrying case outfit.

Platers' Banquet Program.—Program issued by the Philadelphia Branch of the American Electroplaters' Society, for the Seventh Annual Banquet.

METAL STOCK MARKET QUOTATIONS

	Par	Bid	Asked
Aluminum Company of America	$100	$400	$450
American Brass	100	230	237
American Hardware Corp.	100	140	143
Bristol Brass	25	13½	...
International Nickel, com	25	12	12½
International Nickel, pfd	100	67	70
International Silver, com	100	30	40
International Silver, pfd	100	83	87
New Jersey Zinc	100	124	126
Rome Brass & Copper	100	120	...
Scoville Mfg. Co.	100	320	340
Yale & Towne Mfg. Co.	...	250	260

Corrected by J. K. Rice, Jr., & Co., 36 Wall street, New York.

METAL MARKET REVIEW

Written for The Metal Industry by W. T. Partridge

December 1, 1921.

COPPER

Developments in the copper industry in November were of a very satisfactory character. Sales to domestic consumers and on foreign account are estimated to have been approximately 150 to 160 million pounds, as compared with 140 million pounds in October. Deliveries into domestic consumption were probably not much less than 100 million pounds, exports being about 50 million pounds. Statistically considered, the producers now are in a better position than at any time in more than a year, notwithstanding some slight increase in production from United States smelters. Output from refineries during the month is estimated at 85 million pounds. This being, however, 65 million under total deliveries, it indicates a further reduction of that amount in refined stocks. While there is some evidence that larger stocks of Lake and electrolytic are now being carried by second hands, there is no pressure to sell.

Outside market prices at the close were ½c. to ⅝c. per pound above opening levels, with Lake 13.50c. for prompt and December delivered; electrolytic 13.50c. f. o. b. refinery for prompt and December, and January 13.62½c. f. o. b. refinery, and first quarter 1922 13.62½-13.87½c. f. o. b. refinery, and second quarter 13.75-14.00c. f. o. b. refinery; casting copper f. o. b. refinery, 12.87½c. for prompt and December

Producers' prices advanced ½c. to ¾c. during the month, with 13.62½c. for prompt and December and 13.75c. for first quarter 1922 delivered, on the last day of the month.

TIN

While undoubtedly there has been improvement in consumption of tin in this country, due to the usual seasonal activity, it is unfortunate that exaggerated accounts of such improvement were used toward the end of November by speculators in London to advance prices unduly. This is similar to what happened in 1920 when the market, after having been bid up, declined sharply when the speculative support was withdrawn. The tinplate industry is operating at an average rate between 65 and 70 per cent, the leading interest doing somewhat better than the independents. Price fluctuations were from the opening (and also the lowest levels), Straits 28.12½c., American pure 28.25c., and 99 per cent. tin 27.50c. per pound (a decline of ⅛c. on Straits and 99 per cent. tin from October closing) to the highest levels, Straits 30c., American pure nominally the same, and 99 per cent. metal 29.75c., November 28; the closing being Straits and American pure 29.87½c. and 99 per cent. metal 29.62½c. The net result was an advance of 1¾c. on Straits and American pure and 2⅛c. on 99 per cent metal.

LEAD

With only moderate activity continuing throughout November, as compared with greater activity in recent months, the tone of the market remained firm because of the essentially strong and satisfactory statistical position. Prices, both in the outside market and the so-called official basis of the leading interest were stationary throughout the month and unchanged from the October closing levels, 4.70c. East St. Louis and New York, quoted by the American Smelting & Refining Co.; 4.70-4.75c. New York in the outside market for prompt and early. The East St. Louis outside market price opened 4.40-4.45c. for prompt and early and declined on November 10 to 4.35-4.40c. At the close of the month greater activity was in evidence, with prices unchanged, 4.70c. East St. Louis and New York, the American Smelting & Refining Company and outside levels, 4.35c. East St. Louis, 4.70c. New York. The only change throughout the month in prices was the decline of ten points in the East St. Louis outside market level.

ZINC

Increasing activity noted at the close of October carried over into the November zinc market with rising prices which reached the highest levels, 4.75c. East St. Louis, 5.25c. New York, on November 4. The market then turned and gradually quieted down with prices declining as demand fell off.

The lowest levels were reached on November 25, when the market was dull and easy at 4.60-4.65c. East St. Louis, 5.10-5.15c. New York, for prompt, November and December shipments. First quarter 1922 was held 10 points premium, East St. Louis. In the closing days demand was again increasing with galvanizers showing renewed interest, and on the last day of the month prices were advanced to 4.65-4.70c. East St. Louis, 5.15-5.25c. New York, showing complete recovery to the opening levels in asking prices, although bidders were still five points below prices asked.

ALUMINUM

Outside prices in the aluminum market in November were unchanged throughout the entire month at the lower levels established October 28, 17-18c. for 98-99 per cent. virgin, 16-17c. for 98-99 per cent. remelted and 14-15c. for No. 12 remelted. Business was undeniably slow, almost to the point of stagnation, and with small hope of better things until lower freight rates from the West are established. The Aluminum Company of America, on November 28, announced a reduction of 5c. to 5½c. per pound, effective on November 15, to 20c. for 99 per cent. and purer, and to 19c. each for 98-99 per cent. virgin and for No. 12 alloy, all in 15-ton lots f. o. b. producer's plant. By this reduction, the spread between the producer's basis and the prices ruling in the outside market was narrowed from the 6c. to 8c. per pound previously prevailing to about 2c. per pound on virgin ingots and 5c. on No. 12. Sheets were unchanged, 35c. for 18ga flat, and 30c. for 18ga coil.

ANTIMONY

Largely, if not wholly, due to continuing arrivals, the market and also consumers being already well supplied, demand slackened and prices declined from the opening 4.75c. duty paid carloads at the beginning of November to the lowest level of the month, 4.55c. on November 21. There was no change thereafter; this closing represented a decline of 20 points on the pound during the month.

SILVER

Prices of bar silver in November fluctuated from 70¼c. per ounce for foreign bars, the highest level on November 2, to the lowest level, 66¼c., November 26. The opening was 69⅝c. and the closing 67½c, making the net result a decline of 2¾c. per ounce. Domestic bars were quoted 99¼c. throughout the month, the level fixed by the Pittman act, and total purchases under this bill had, on November 14, amounted to 80,662,863 ounces, as compared with 207,000,000 ounces, the full amount to be purchased and for which the bill provides.

QUICKSILVER

There was a gradual advance in prices of quicksilver in November from the closing October level, $40-41 per flask of 75 pounds each, to $48 per flask on November 29, which was due to diminishing supplies and more active demand.

PLATINUM

Larger supplies and less demand for platinum in November caused a decline from $85 per ounce at the beginning of the month to $80 per troy ounce for pure, during the last week of the month.

OLD METALS

No change from the steady buying of scrap which developed in October was apparent during the first week of November, but by the middle of the month some falling off in demand was noted. Prices, however, were well maintained, and after the holidays in second week, activity increased, with coppers leading as before. By the end of the month this satisfactory condition still existed, although the approach of the stock-taking season, it was thought, might later cause some falling off in demand. Net price advances were 1¼c. per pound on uncrucibled copper to 10.75c.; on No. 1 pewter 1c. to 16c.; on block tin pipe 2c. to 23c. Advances of ½c. per pound each were, light copper to 8.50c., new brass clippings to 6.50c., No. 1 composition turnings to 6.50c., clean aluminum borings to 5c., and new type shell cuttings to 8c. Other advances were ¼c. per pound on old cast aluminum to 9.75c., new zinc scrap to 3c., battery lead to 2c. and old zinc scrap to 2.50c. A decline of ½c. to 2.50c. was registered on clean hand picked type shells.

NOVEMBER MOVEMENT IN METALS

	Highest	Lowest	Average
Copper:			
Lake	13.50	13.00	13.30
Electrolytic	13.50	12.87½	13.161
Casting	12.87½	12.37½	12.53
Tin	30.00	27.87½	29.017
Lead	4.45	4.35	4.375
Zinc (brass special)	4.85	4.70	4.783
Antimony	4.80	4.55	4.66
Aluminum	18.00	17.00	17.50
Quicksilver (per flask)	48.00	40.00	42.658
Silver (cts. per oz.) foreign	70¼	66¼	68.234

WATERBURY AVERAGE

Lake Copper.—Average for 1920, 18.06—January, 1921, 13.75—February, 13.50—March, 12.625—April, 12.75—May, June, 5.00—July, 4.80—August, 4.70—September, 4.75—October, 12.375—October, 13.125—November, 13.375.

Brass Mill Zinc.—Average for 1920, 8.33—January, 1921, 6.05—February, 5.50—March, 5.25—April, 5.20—May, 5.30—June, 5.00—July, 4.80—August, 4.70—September, 4.75—October, 5.10—November, 5.15.

Metal Prices, December 5, 1921

NEW METALS

Open Market

	Cents
COPPER—DUTY FREE. PLATE, BAR, INGOT AND OLD COPPER.	
Manufactured 5 per centum.	
Electrolytic, carload lots, delivered	13¾c.
Lake, carload lots, delivered	13½-13¾c.
Casting, carload lots, delivered	13c.
TIN—Duty free.	
Straits, carload lots	30.37½c
LEAD—Duty, Pig, Bars and Old, 25%; pipe and sheets, 20%. Pig, carload lots	4.75-4.80
ZINC—Duty 15%.	
Brass Special	5.30-5.35
Prime, Western, carload lots	5.20-5.25
ALUMINUM—Duty, Crude, 2c. per lb. Bales, sheets, bars and rods, 3½c. per lb.	
Small lots, f. o. b. factory	.....
100-lb. f. o. b. factory	.....
Ton lots, f. o. b. factory	17-20
ANTIMONY—Duty 10%.	
Cookson's Hallet's or American	Nominal
Chinese, Japanese, Wah Chang WCC, brand spot	4.55
NICKEL—Duty, Ingot, 10% ad valorem. Sheet, strip, strip and wire, 20%.	
Ingot	41.00
Shot	41.00
Electrolytic	44.00
MANGANESE METAL—95-98% Mn., carbon free, per lb. Mn. contained	0.75
MAGNESIUM METAL—Duty 20% ad valorem (100 lb. lots)	$1.25-1.35
BISMUTH—Duty free	1.50-1.55
CADMIUM—Duty free	1.00-1.25
CHROMIUM METAL—95-98% Cr., per lb. Cr. contained	1.50
COBALT—97% pure	3.00-3.25
QUICKSILVER—Duty 10% per flask of 75 lbs	48
PLATINUM—Duty free, per ounce	$80
SILVER—Government assay—Duty free, per ounce	.99¼
GOLD—Duty free, per ounce	20.67

Metal Prices, December 5, 1921

INGOT METALS

Silicon Copper, 10%	according	to	quantity	34 to38
Phosphor Copper, guaranteed 15%	"	"	"	16⅛to28¾
Phosphor Copper, guaranteed 10%	"	"	"	15⅞to27⅞
Manganese Copper, 30%	"	"	"	50 to56
Phosphor Tin, guarantee 5%	"	"	"	35⅝to45⅝
Phosphor Tin, no guarantee	"	"	"	37 to48
Brass Ingot, Yellow	"	"	"	8¾to11½
Brass Ingots, Red	"	"	"	11½to14
Bronze Ingot	"	"	"	12 to14½
Parsons Manganese Bronze Ingots	"	"	"	16½to18
Manganese Bronze Castings	"	"	"	24 to33
Manganese Bronze Ingots	"	"	"	13 to16
Manganese Bronze Forgings	"	"	"	30 to40
Phosphor Bronze	"	"	"	24 to30
Casting Aluminum Alloys	"	"	"	18 to21
Monel Metal	"	"	"	38

OLD METALS

Buying Prices		Selling Prices
10¼to10¾	Heavy Cut Copper	11¾to12
10 to10½	Copper Wire	11½to11¾
8½to 9	Light Copper	10 to10½
9 to 9½	Heavy Machine Comp	11 to11½
6½to 7	Heavy Brass	8 to 8½
5 to 5½	Light Brass	6½to 7
5½to 6	No. 1 Yellow Brass Turnings	6½to 7
7½to 8	No. 1 Comp. Turnings	9 to 9½
4	Heavy Lead	4½
4	Zinc Scrap	4½
5 to 5½	Scrap Aluminum, Turnings	7 to 8
10½to11½	Scrap Aluminum, cast alloyed	12½to13½
13½to14½	Scrap Aluminum, sheet (new)	15½to16½
18½	No. 1 Pewter	22½
15	Old Nickel anodes	17
23 to25	Old Nickel	27 to29

BRASS MATERIAL—MILL SHIPMENTS

In effect Dec. 1, 1921

To customers who buy 5,000 lbs. or more in one order.

	Net base per lb.		
	High Brass.	Low Brass.	Bronze.
Sheet	$0.16¾	$0.18¼	$0.19¾
Wire	0.17¼	0.18¾	0.20¼
Rod	0.14¾	0.19¼	0.20¾
Brazed tubing	0.25½	....	0.30½
Open seam tubing	0.25½	....	0.30½
Angles and cannels	0.30½	....	0.35½

To customers who buy less than 5,000 lbs. in one order.

	Net base per lb.		
	High Brass.	Low Brass.	Bronze.
Sheet	$0.17¾	$0.19¼	$0.20¾
Wire	0.18¼	0.19¾	0.21¼
Rod	0.15¾	0.20¼	0.21¾
Brazed tubing	0.26½	....	0.31½
Open seam tubing	0.26½	....	0.31½
Angles and channels	0.31½	....	0.36½

SEAMLESS TUBING

Brass, 18½c. to 19½c. per lb. base.
Copper, 21¼c. to 22¼c. per lb. base.

TOBIN BRONZE AND MUNTZ METAL

Tobin, Bronze Rod	18¾c. net base
Muntz or Yellow Metal Sheathing (14"x48")	16¾c. " "
Muntz or Yellow Rectangular Sheets other than Sheathing	17¾c. " "
Muntz or Yellow Metal Rod	14¾c. " "

Above are for 100 lbs. or more in one order.

COPPER SHEET

Mill shipments (hot rolled)	21c.-22c. net base
From stock	22c.-26c. net base

BARE COPPER WIRE—CARLOAD LOTS

15¼c. to 15½c. per lb. base.

SOLDERING COPPERS

300 lbs. and over in one order	19¼c. per lb. base
100 lbs. to 300 lbs. in one order	19¾c. per lb. base

ZINC SHEET

Duty, sheet, 15%. Cents per lb.

Carload lots, standard sizes and gauges, at mill, 9c. basis less 8 per cent. discount.

Casks, jobbers' prices	10c. to 10½c.
Open casks, jobbers' prices	11c. to 12c.

ALUMINUM SHEET AND COIL

Aluminum sheet, 18 ga. and heavier, base price	35c.
Aluminum coils, 24 ga. and heavier, base price	30c.

NICKEL SILVER (NICKELENE)

Base Prices

Grade "A" Nickel Silver Sheet Metal

10% Quality	26¼c. per lb.
15% "	28¾c. " "
18% "	29½c. " "

Nickel Silver Wire and Rod

10% Quality	28c. per lb.
15% "	32¼c. " "
18% "	35c. " "

MONEL METAL

Shot	35
Blocks	35
Sheet Bars	40
Hot Rolled Rods (base)	42
Cold Drawn Rods (base)	56
Hot Rolled Sheets (base)	55

BLOCK TIN SHEET AND BRITANNIA METAL

Block Tin Sheet—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more, 10c. over Pig Tin. 40 to 100 lbs., 15c. over 25 to 50 lbs., 17c. over, less than 35 lbs., 25c. over.

No. 1 Britannia—18" wide or less. No. 26 B. & S. Gauge or thicker, 500 lbs. or over, 8c. over N. Y. tin price; 100 lbs. or more, 10c. over Pig Tin. 50 to 100 lbs., 15c. over, 25 to 50 lbs., 20c. over, less than 25 lbs., 25s. over. Above prices f. o. b. mill.

Lead Foil—base price—figured on base price of lead at the time.

Platers' metal, so called, is very thin metal not made by the larger mills and for which prices are quoted on application to the manufacturer.

SILVER SHEET

Rolled silver anodes .999 fine are quoted at from 71c. to 73c. per Troy ounce, depending upon quantity.

Rolled sterling silver, 68c. to 71c.

NICKEL ANODES

85 to 87% purity	.40c- .45c. per lb.
90 to 92% "	.42½c.-47½c. per lb.
95 to 97% "	.45c. .50c. per lb.

Supply Prices, December 5, 1921

CHEMICALS

In Commercial Quantities—New York Prices

Acid—		
Boric (Boracic) Crystals	lb.	.14
Hydrochloric (Muriatic) Tech., 20 deg., Carboys	**lb.**	**.02½**
Hydrochloric, C. P., 20 deg., Carboys	lb.	.08
Hydrofluoric, 30%, bbls	**lb.**	**.08**
Nitric, 36 deg. Carboys	lb.	.07
Nitric, 42 deg. Carboys	lb.	.07¼
Sulphuric, 66 deg., Carboys	lb.	.02½
Alcohol—		
Denatured in bbls.	gal.	.47-.50
Alum—		
Lump, Barrels	lb.	.04
Powdered, Barrels	lb.	.05
Aluminum sulphate, commercial tech	lb.	.02½-.03
Aluminum chloride solution	lb.	.20
Ammonium—		
Sulphate, tech., Barrels	**lb.**	**.04**
Sulphocyanide	lb.	.50
Argols, white, see Cream of Tartar	lb.	.29
Arsenic, white, Kegs	lb.	.06½
Asphaltum	lb.	.35
Benzol, pure	gal.	.45
Blue Vitrol, see Copper Sulphate.		
Borax Crystals (Sodium Biborate), Barrels	lb.	.05½
Calcium Carbonate (Prescipitated Chalk)	lb.	.05
Carbon Bisulphide, Drums	lb.	.07½
Chrome Green	**lb.**	**.40-.45**
Cobalt Chloride	lb.	—
Copper—		
Acetate	lb.	.48
Carbonate, Barrels	lb.	.18
Cyanide	lb.	.59
Sulphate, Barrels	lb.	.05¾
Copperas (Iron Sulphate, bbl.)	lb.	.02½
Corrosive Sublimate, see Mercury Bichloride.		
Cream of Tartar, Crystals (Potassium bitartrate)	lb.	.29
Crocus	lb.	.15
Dextrin	lb.	.05-.08
Emery Flour	lb.	.06
Flint, powdered	**ton.**	**$30.00**
Fluor-spar (Calcic fluoride)	ton	$75.00
Fusel Oil	gal.	3.25
Gold Chloride	oz.	14.00
Gum—		
Sandarac	lb.	.30
Shellac	lb.	—
Iron, Sulphate, see Copperas, bbl	lb.	.02½
Lead Acetate (Sugar of Lead)	lb.	.12-.13
Yellow Oxide (Litharge)	**lb.**	**.09**
Mercury Bichloride (Corrosive Sublimate)	lb.	.68
Nickel—		
Carbonate Dry	lb.	.50-.55
Chloride, 100 lb. lots	lb.	.30-.40
Salts, single, bbls.	lb.	.14
Salts, double, bbl.	lb.	.11½
Paraffin	lb.	.07-.10
Phosphorus—Duty free, according to quantity		.25-.30
Potash, Caustic, Electrolytic 88-92% fused, drums	lb.	6½
Electrolytic, 70-75% fused	**lb.**	**.10**
Potassium Bichromate, casks	lb.	.11
Carbonate, 80-85%, casks	**lb.**	**.07**
Cyanide, 165 lb. cases, 94-96%	lb.	.45
Pumice, ground, bbls	lb.	.04
Quartz, powdered	ton.	$30.00
Official	oz.	—
Rosin, bbls.	**lb.**	**.03½**
Rouge, nickel, 100 lb. lots	lb.	.20
Silver and Gold	lb.	.60
Sal Ammoniac (Ammonium Chloride) in casks	lb.	.07½
Silver Chloride, dry	oz.	.86
Cyanide	oz.	—
Nitrate, 100 ounce lots	oz.	.47
Soda Ash, 58%, bbls	**lb.**	**.03**
Sodium—		
Biborate, see Borax (Powdered), bbls	lb.	.05½
Bisulphate, tech., bbls	lb.	.03½
Cyanide, 96 to 98%, 100 lbs	lb.	.30
Hydrate (Caustic Soda) bbls	lb.	.04½
Hyposulphite, kegs	lb.	.04
Nitrate, tech. bbls	**lb.**	**.04½**
Phosphate, tech., bbls	lb.	.06
Silicate (Water Glass) bbls	lb.	.03
Sulpho Cyanide	lb.	.60
Soot, Calcined	lb.	—
Sugar of Lead, see Lead Acetate	lb.	.12-.13
Sulphur (Brimstone) bbls	**lb.**	**.03**
Tin Chloride	lb.	.33
Tripoli	lb.	.03½
Verdigris, see Copper Acetate	lb.	.48
Water Glass, see Sodium Silicate, bbls	lb.	.03
Wax—		
Bees, white ref. bleached	lb.	.55
Yellow, No. 1	lb.	.21
Whiting, Bolted	lb.	.02½-.06
Zinc, Carbonate, bbls	lb.	.14-.18
Chloride, 600 lb. lots	lb.	.07½
Cyanide	lb.	.42
Sulphate, bbls.	**lb.**	**.03½**

COTTON BUFFS

Open buffs, per 100 sections (nominal).

12 inch, 20 ply, 64/68, cloth	base,	$33.80
14 " 20 " 64/68, "	"	42.05
12 " 20 " 84/92, "	"	46.20
14 " 20 " 84/92, "	"	62.25
Sewed Buffs, per pound		
Bleached and unbleached	"	.50

FELT WHEELS

		Price Per Lb. Less Than 100 Lbs.	100 to 300 Lbs.	300 Lbs. and Over
Diameter—6" to 24"	½" to 1"	$3.20-3.50	$3.15-3.40	$3.10-3.25
" 10" to 16"	1" to 3"	2.30-2.50	2.25-2.40	2.20-2.25
" 6" to 24"	Over 3"	2.70-2.90	2.65-2.80	2.60-2.65
" 6", 8" and over 16"	1" to 3"	2.30-2.60	2.25-2.50	2.20-2.35
" 4" to 6"	¾" to 3"	4.00-4.50	Any quantity	
" Under 4"	¼" to 3"	4.50-5.10	Any quantity	

Grey Mexican or French Grey—10c. less per lb. than Spanish, above.

The Business Tide Is Bound To Turn—It's Turning NOW for 1922

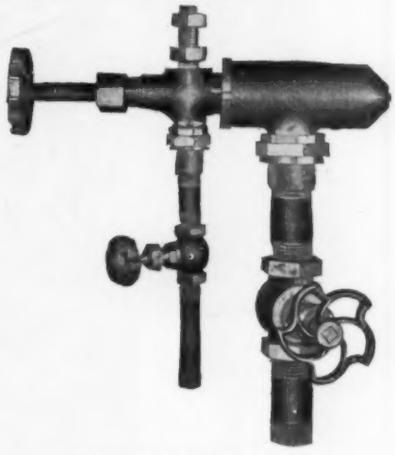
It's time for you to bring your foundry up to the highest possible state of preparedness if you expect to compete successfully against keener competition than ever for the desirable class of business.

Don't be forced through lack of proper melting equipment to let your rivals skim the nourishing cream and leave you only the thin milk.

Go after the profitable kind of business with an installation of up-to-date

MONARCH FURNACES

REVOLVING FURNACE—MOTOR DRIVEN
For Melting Brass, Copper, Gold, Silver and Other Metals



OIL BURNERS, WITH AIR
For All Purposes

Ask for Catalog TMI $\frac{12}{1921}$

"Steele-Harvey"
Crucible Metal Melting and Refining Furnace

also

"Rockwell" Furnaces
Revolving, Double Chamber, Simplex, Reverberatory, Vertical, without Crucibles

OIL AND GAS—ALL SIZES
Tilting Crucible Pit Crucible
Stationary Crucible

ALL SIZES—ALL FUELS
Oil—Gas—Coal—Coke

TILTING CRUCIBLE FURNACE—ALL FUELS
For Melting Ores, Metals, Etc.

LADLE HEATER
For Heating Foundry Ladles

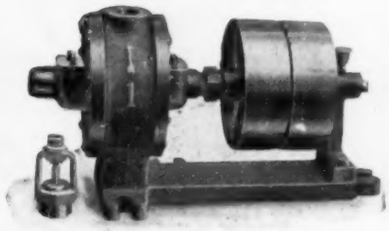
Acme Core Ovens
Overhead Trolley

Arundel Core Ovens
Drop Front

ALL SIZES—ALL FUELS

CORE OVENS—ALL SIZES AND FOR ALL FUELS
For Foundry Cores

Miscellaneous Appliances



POSITIVE PRESSURE BLOWERS
Air 1 to 10 lb.—From 10 to 1000 Ft. Capacity

The Monarch Engineering & Manufacturing Co.

1206 American Bldg.
Baltimore, Md.

New York Office, 50 Church St.
Shops at Curtis Bay, Md.

Boronic Babbitts Cost Too Much?????

IF BORONIC BABBITTS WEAR BETTER AND GIVE LONGER SERVICE, IT FOLLOWS THAT THERE IS LESS EXPENSE TO BE CONSIDERED IN THE RENEWALS AND INTERRUPTIONS OF BUSINESS ATTACHING TO THE GENERAL USE OF INFERIOR BABBITTS. THUS, LONGER WEAR, AND BETTER SERVICE AND LESS COST FOR INTERRUPTIONS AND RENEWALS MUST BACK OUR CLAIMS FOR BORONIC BABBITTS AS BY FAR CHEAPER THAN OTHER BABBITTS.

IN PROOF OF OUR CLAIMS, WE CITE ACTUAL EVIDENCE:

Possibly the largest Granite Crushing plant in the United States, which had been using over 1200 pounds of the best BABBITT they could buy for their annual consumption, have reduced their annual requirements (through use of Boronic Babbitt) to about one-fourth of this amount, while actually increasing their output, as their Granite products are in greater demand than ever, because of increased road building demands.

One of the largest Oil Companies in the world has found an increase in wear of over 46% with BORONIZED BABBITTS, over the best grade of BABBITT which they had used before.

One of the largest Silk Manufacturing Companies in this country has been purchasing what they considered "the best brand of BABBITT we could buy,"—this being one of the most popular "BRANDS" on the market, and they have been "IMPROVING" this high-grade BABBITT during the past several years by the use of our No. 3, BORONIC COPPER ALLOY.

BORONIC BABBITTS and BABBITTS BORONIZED are worth your giving your best mathematical thought and reasoning. If you will come to where you can COMPEL YOURSELF TO BELIEVE that there are some very simple problems (which are made simple by our help) for you to solve for your own good FIRST, and ours incidentally, you'll write us and have us send you our literature and, if necessary our experts—we make no charge for SERVICE, other than through our PRODUCTS—WHO WILL CONFIRM ALL WE SAY, OR COULD SAY IN FAVOR OF BORONICS FOR YOUR SPECIAL USE.

When sending for our literature, ask for our list of 27 numbers of BORONIC SPECIFICS, the same being for the cure of all metal ills and used in all metals, "from Gold to Steel."

To the Metal Manufacturer, or the Individual Mixer of Metals:
PLEASE USE THIS COUPON.

American Boron Products Co., Inc., Reading, Pa.

Gentlemen:—Please send me complete details regarding the many ways whereby I can economize by using BORONIC ALLOYING METALS. MI-12-21. My address is:

Name .....

City .....

State .....

AMERICAN BORON PRODUCTS CO., Inc.

(SOLE MANUFACTURERS)

READING, PENNSYLVANIA, U. S. A.

FOREIGN DISTRIBUTORS:

EDWARD LE BAS & CO., London, E. C. 3, Eng. NATIONAL ALLOYS, LTD., London, Eng.

CHINA, JAPAN & SOUTH AMERICA TRADING COMPANY, LTD.
No. 42 Kiangse Road, Shanghai, China
No. 13 Honkoku-cho Sanchome, Nihonbashi-ku, Tokyo, Japan
No. 20 Nakanoshima 7 Chome, Osaka, Japan

Baird Tumblers For All Purposes

Single Oblique Cast Barrel

ALL TYPES OF MACHINES—oblique tilting, horizontal, exhaust, non-exhaust, single, double, four-barrel, steam drying, japanning, ball burnishing.

EVERY TYPE OF BARREL—cast brass, cast iron, sheet brass, sheet iron, sheet copper, wood, cast iron with wood lining, wood barrel with metal lining, wood barrel with metal bottom or any other variation or combination of material. Barrels may be round, octagonal, four or eight sided, long or short, wide or narrow. They may be smooth inside or fitted with fins, or steps, or any one of many arrangements to effect the movement of work inside the barrel. There may be covers, or sieves, or divisions, special methods of heating or cooling or applying water, loading or unloading.

Japanning Barrel

Baird-Warner

DESCRIPTIONS OF VARIOUS TYPES OF TUMBLERS ARE GIVEN IN BULLETINS 300, 301, 302, 303 AND 309. THEY WILL BE SENT ON REQUEST.

The Baird Machine Company

Bridgeport **Connecticut**

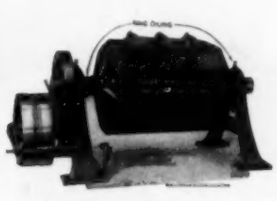
FOREIGN REPRESENTATIVES

R. CRUICKSHANK, LTD.	BIRMINGHAM, ENGLAND
Societe Anonyme des Etablissements FENWICK FRERES & CO.	PARIS, FRANCE
FENWICK FRERES, 1 Avenue Blonden	LIEGE, BELGIUM
FRATELLI FENWICK, 6 Via Lagrange	TORINO, ITALY
VICTOR SOUSSAN, 29 Rua de Goncalves Dias	RIO DE JANEIRO, BRAZIL
B. V. CONSTANTINOV "Industry Corp."	MOSCOW AND KRASNOIARSK, RUSSIA
ZAYAS ABREU COMMERCIAL CO.	HAVANA, CUBA

Steam Drying Barrel

Ball Burnishing Barrel

Single Horizontal Grinding



Heavy Back Geared Grinding

No Other Metal Preservative In the World Like It!

EVERY manufacturer of metal, art or toilet articles, scientific instruments, automobile fittings, fire arms, musical instruments, lighting and bathroom fixtures, in fact any metal hardware, wants to keep his products looking their best, for the longest possible time.

IZEN, the marvellous metal preservative, will **positively prevent tarnish, rust, corrosion** and **deterioration.** It preserves polished metals of every description.

Can be used with equal success on **brass,** nickel, copper, steel, silver, zinc, or any other metal.

Do not confuse IZEN with ordinary lacquers or shellacs, or with the metal coatings generally used.

IZEN is colorless, transparent and flexible. It instantly waterproofs all materials to which it is applied. Atmospheric conditions do not affect the lustre of IZENed metal.

Every manufacturer who wants the assurance that the **finish** on his goods will be just as reliable as are the goods themselves should use IZEN.

Easily and quickly applied. Requires no skilled labor. Izen air dries. No baking process required.

We guarantee a covering surface with IZEN at least three times greater than now obtained by the use of lacquer.

To increase your sales and enlarge your satisfied family of consumer friends, IZEN the surface, and increase and indefinitely prolong the beautiful finish of your goods.

Send to-day for literature and liberal samples of IZEN—the Revelation In Modern Metal Finish.

izen company inc.
299 madison ave.
new york

Chicago, Ill.
717 Conway Building

Los Angeles, Cal.
1015 Hollingsworth Bldg.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., required by the Act of Congress of August 24, 1912, of THE METAL INDUSTRY, published monthly at New York, N. Y., for October 1, 1921.

State of New York, } ss.
County of New York }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Palmer H. Langdon, who, having been duly sworn according to law, deposes and says that he is the publisher of THE METAL INDUSTRY, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Palmer H. Langdon, 99 John street, New York; Editor, Palmer H. Langdon, 99 John street, New York; Managing Editor, Adolph Bregman, 99 John street, New York; Business Managers, Geo. W. Cooper and Thos. A. Trumbour, 99 John street, New York.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent. or more of the total amount of stock.) The Metal Industry Publishing Company, 99 John street, New York; Palmer H. Langdon, 99 John street, New York; L. J. Langdon, 99 John street, New York; Thos. T. Trumbour, 99 John street, New York; John B. Woodward, 99 John street, New York.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent. or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct in the said stock, bonds, or other securities than as so stated by him.

THE METAL INDUSTRY, Palmer H. Langdon, Publisher.

Sworn to and subscribed before me this 7th day of October, 1921.

[Seal]

O. B. LEWIS, Notary Public, Kings County Clerk's No. 15.

Certificates filed: New York County Clerk's No. 44; New York County Register's No. 2,019. (Commission expires March 30, 1922.)

DIRECTORY

Copper, Brass and Other Metal Rolling Mills

MANUFACTURERS OF PLATE, SHEET, ROD, WIRE, TUBE, INGOT, METAL GOODS

DIRECTORY

Copper, Brass and Other Metal Rolling Mills

MANUFACTURERS OF PLATE, SHEET, ROD, WIRE, TUBE, INGOT, METAL GOODS

TIN & LEAD FOIL
BLOCK TIN SHEET & PIPE
BRITANNIA SHEET & CASTING METAL
LEAD & COMPOSITION TUBING
MUSIC ENGRAVERS PLATES
INQUIRIES INVITED
Dept. "B"
Standard Rolling Mills, Inc.
363-65-67 Hudson Avenue
BROOKLYN, N. Y.

Hendricks Brothers
Manufacturers of
Sheet and Bar Copper
COPPER FIRE BOX PLATES and STAYBOLTS
WIRE AND BRAZIERS RIVETS
Importers and Dealers in
INGOT COPPER, BLOCK TIN
SPELTER, LEAD, ANTIMONY
BISMUTH, NICKEL, Etc.
49 Cliff Street New York

Rome Hollow Wire & Tube Company
Main Office and Mill,
ROME, N. Y.
Manufacturers of
SEAMLESS BRASS AND COPPER TUBING
Making a specialty of the smaller sizes and thin gauges

C. G. Hussey & Co.
PITTSBURGH, PENNA.
Manufacturers of
COPPER
IN SHEETS, PLATES, ROLLS
ANODES
TACKS AND NAILS

Copper Rods
Bare and Tinned
Copper Wires
ROME WIRE CO.
ROME, N. Y.

Brass, Bronze, Copper
in
Thin Gauges
The Baltimore Brass Co.
1201 Wicomico St. Baltimore, Md.

Sheet Brass
and
Nickel Silver
THE
DUEBER
WATCH CASE MFG. CO.
CANTON, OHIO U. S. A.

THE METAL INDUSTRY FOR 1922 BETTER THAN EVER

Keep your name before the trade
For Space in This Directory
Address
The Metal Industry
99 John St., New York

MANUFACTURERS OF PLATED SHEET METALS

NATIONAL SHEET METAL COMPANY
Manufacturers of
NICOLENE, Brassene, Copperene and Bronzene Nickel Tin, Brass Tin, Bronze Tin, Copper Tin, Oxidized Copper Tin, Sheet Zinc, polished.
Large Saving to Manufacturers.
Because plated sheets are much cheaper than solid brass or copper sheets, and no plating is required after the article is made up. *Prompt deliveries*
For further information Address office, PERU, ILLINOIS

NICKELOID Also COPPEROID BRASSOID NICKEL PLATED TIN BRASS PLATED TIN COPPER PLATED TIN
NICKEL PLATED SHEET ZINC
Can Be Stamped, Drawn and Soldered
WILL NOT RUST
Prompt delivery on stock size sheets
AMERICAN NICKELOID CO.
PERU - ILLINOIS
The first and largest mill in America to manufacture Plated Sheets.
R. Rothschild
Eastern Sales Agents
207 NORMAN AVE.
BROOKLYN

MANUFACTURERS USING SHEET METALS:
Save Money,
Secure Quicker Delivery of Materials,
Make a Superior Article
without adding to the cost. Write today for further information concerning APOLLO PLATED SHEET METALS, which, used as raw material, produce articles highly finished ready for the market without requiring any plating or polishing after assembling.
APOLLO METAL WORKS, LA SALLE, ILL.

For Advertising Rates and "ABC" Verified Circulation Report, Address, THE METAL INDUSTRY, 99 John Street, New York City

DIRECTORY

Lead and Zinc Smelters and Manufacturers

PRODUCERS OF PIG LEAD, SLAB SPELTER, ZINC ROD, SHEET ZINC, ACIDS

DIRECTORY

Metal Smelters, Refiners, Dealers

PRODUCERS, ALSO BUYERS AND SELLERS OF NEW AND OLD METALS

DIRECTORY

Contract Workers

CASTING, STAMPING, ETCHING, PLATING, POLISHING, SPECIALTIES, ETC.

PROFESSIONAL DIRECTORY

TRADE WANTS

AN EXCHANGE FOR THE WANTS OF THE METAL AND PLATING TRADES

ANSWERS SENT IN CARE OF THE METAL INDUSTRY · WILL BE FORWARDED

FOR SALE—EQUIPMENT, ETC.

Display Advertisements, One Column Wide, $3 per inch, Each Insertion.

PLATING EQUIPMENT

FOR SALE: All kinds of plating equipment, dynamos, tanks, plating barrels, supplies, etc.

We are not going out of business but have to make room.

Write for prices to

A. A. BRUNELL CO., INC.
15 Vine Street, Worcester, Mass.

Buy With Rent

6-story daylight factory, totaling

40,000 Square Feet

Fireproof; electric power plant; reinforced stamping floor; prominent street near Chelsea Piers and Railroads.

JAMES N. WELLS' SONS
191 Ninth Avenue (Near 22d St.) **New York**

ROSIN PULVERIZER

FOR SALE—No. 1 Mead Mill suitable for grinding any material. Will sell cheap on account of installing larger equipment. Address:

NATROLIN,
Greensburg, Pa.

FACTORY

FOR SALE—Factory, 50 x 150, one story, brick, modern, used in manufacturing flatware. Including complete equipment, hammers, punch presses, plating and buffing machinery, machine shop and supplies. Located near Philadelphia. Good labor conditions.

717 LAFAYETTE BUILDING,
Philadelphia, Pa.

GENERATOR

FOR SALE—Z. L. & L. generator, 6 volt, 750 amp., shunt type, S. H. speed, 1000 R. P. M. First-class condition—crated ready for immediate delivery. Price $250.00. Address:

Z. L. & L.,
Care THE METAL INDUSTRY.

PLATING EQUIPMENT

FOR SALE—Four tanks, one plating barrel, steam jackets, kettle, copper and nickel anodes for sale cheap.

CLIFF MANUFACTURING CO.,
316 Avenue A,
New York City.

ROBINSON AUTOMATIC GRINDING MACHINE

FOR SALE—1 Robinson automatic grinding machine practically new. Will sell at one-half price.

HOMER FURNACE CO.,
Coldwater, Michigan.

GENERATOR SET

FOR SALE—Reason: change of current. A Green's 1921 model generator set at 5 volts, power end 110 volts, with Rheostat complete. Cost $225.00. Used less than one month. Sacrifice sale. Address:

DR. F. C. HARMS,
Rochelle Park, New Rochelle, N. Y.

WANTED—EQUIPMENT, ETC.

Display Advertisements, One Column Wide, $3 per inch, Each Insertion

TUMBLING BARRELS

WANTED—Only interested in several "Baird" No. 1 burnishing barrels. Address:

BURNISHING BARRELS,
Care THE METAL INDUSTRY.

EQUIPMENT

WANTED—Automatic lock-seaming machine, Stolp preferred, to make tubes 9" long. State condition, number of dies and lowest price. Address:

STOLP,
Care THE METAL INDUSTRY.

BURNISHING BARREL

WANTED—Used Abbott Ball Burnishing Barrel. State condition and price.

PHILADELPHIA CASKET HARDWARE CO.,
Philadelphia, Pa.

Your Advertisement Here Would Be Seen by Thousands of Readers

TRADE WANTS—Continued

COMMERCIAL INQUIRIES AND OPPORTUNITIES

The following inquiries for Metals, Machinery and Supplies have been received. Names of inquirers may be obtained from The Metal Industry, 99 John St., New York, N. Y.

Inquiry 2813—Please give us the addresses of concerns that make fancy brass mounts for fire sets and fenders and fancy brass moldings.

Inquiry 2814—Kindly give us the names of firms making aluminum-bronze ingots.

Inquiry 2815—Where can we get egg beater castings made from our patterns in gray iron (one large gear, one small gear and handles)?

Inquiry 2816—Please put me in touch with a firm able to make 250,000 ferrules from 2⅜"-5" inside diameter, 2⅞"-5⅜" outside diameter, 1½"-2½" long, either steel tubing or flat strip "springy" steel. Inside must be a true circle. If rolled up from strip a ¾" gap could be left in ferrule. Trade mark to be rolled in metal and outside of ferrule knurled—blue steel, bright finish or nickel plate.

Inquiry 2817—Please tell us who are manufacturers, not jobbers, of platers' composition such as tripoli, white finish, etc.

Inquiry 2818—We are in the market for register or radiator grilles stamped from sheet bronze and sheet steel.

Inquiry 2819—I have a few samples of brass ingots, weighing 8 oz. each, also some white metal ingots that I would like to have rolled to No. 11 gauge. Am thinking of purchasing a small rolling outfit. Please advise who makes them.

Inquiry 2820—Who makes Imperial white finishing composition?

Inquiry 2821—Who makes iron pots suitable for boiling muriatic acid, to be used direct on flame?

Inquiry 2822—Who makes carboy inclinators?

Inquiry 2823—Please put us in touch with concerns making automatic buffing machines that will successfully handle aluminum cooking utensils.

Inquiry 2824—Who handles Pickalette, an imported material used to neutralize nitrogen in pickling solution?

Inquiry 2825—We understand there is a pickling acid compound used for cleaning forgings by immersing them in the solution and putting them direct into the annealing furnace without rinsing. Can you give us any further information regarding this material?

Inquiry 2826—Please send us the address of the concern that manufactures Garford aero metal.

SITUATIONS OPEN

Display Advertisements, One Column Wide, $3 per inch, Each Insertion

ALLOY FOUNDRY FOREMAN

SITUATION OPEN: This position requires a man who has had considerable experience on melting and casting high grade alloys for bearings, etc. Will consider young man whose record shows successful experience and ability and can apply modern practices to alloy work. In answering give all information as to past experience. Address

ALLOY FOUNDRY FOREMAN,
Care The Metal Industry

POLISHING FOREMAN

SITUATION OPEN: Polishing foreman to take charge of room of coarse and grease buffers. Want man who has had experience on hair-clippers, shears, pliers, manicure and surgical instruments, etc., and one who can furnish reference as having been foreman for a number of years. Factory located in Jersey. State age, whether married or single, where employed at the present time, and salary expected. Address:

JERSEY,
Care THE METAL INDUSTRY.

SALESMAN

SITUATION OPEN—With shop knowledge stamping dies, acquaintance in metal working field, to sell Standard Punch and Die Sets, commission basis, giving all or part time but keeping territory active. Give mechanical and selling experience, references, territory desired. Our co-operation assured. Address:

SALESMAN,
Care THE METAL INDUSTRY.

SUPERINTENDENT

SITUATION OPEN—Superintendent for a builders' hardware manufacturing company. State experience, age and salary expected. Address:

CANADA,
Care THE METAL INDUSTRY.

PRACTICAL SHEET METAL MAN

SITUATION OPEN—A man who can lay out and help develop economical manufacturing of ventilation systems and other sheet metal work. Must be good handler of men, able to develop the inexperienced into good sheet metal workers, obtaining quantity production. Address:

GEO. JAMES, James Mfg. Co.,
Ft. Atkinson, Wisc.

PLATER

SITUATION OPEN: Plater experienced on silverplating flatware preferred. Man capable taking entire charge plating department. Must be competent chemist. Apply stating salary required, age, experience, etc. Address:

P. O. Box 142,
Niagara Falls, N. Y.

FINISHER AND LACQUERER

SITUATION OPEN—Man with wide experience in acid finishing and lacquering brass goods to connect with large reliable house. State full qualifications and experience in letter. Address:

LACQUER,
Care THE METAL INDUSTRY.

SITUATIONS WANTED

Display Advertisements, One Column Wide, $1 per inch, Each Insertion

EXECUTIVE

SITUATION WANTED—Position as executive with concern manufacturing table flatware or cutlery. Fully experienced along these lines. Knows modern plating and finishing methods, can install practical cost and production systems, fitting the system to the individual case. Technically trained and knows how to overcome manufacturing difficulties and how to handle men. Address: EXECUTIVE,
Care THE METAL INDUSTRY.

CHEMIST

SITUATION WANTED—Authority on buffing and polishing compositions open for consultation. Samples furnished on request. Address:

CHEMIST,
Care THE METAL INDUSTRY.

TRADE WANTS—Continued

SITUATIONS WANTED—Continued

Display Advertisements, One Column Wide $1 Per Inch, Each Insertion

COPPER MILL SUPERINTENDENT

SITUATION WANTED: Copper mill superintendent with long experience with one of the largest mills in the country wishes to engage with concern about to undertake copper sheet and strip rolling. Can assume all responsibilities relating to planning, supervision of machine installations and finishing of the product. Address

COPPER MILL SUPERINTENDENT,
Care The Metal Industry.

FOREMAN PLATER

SITUATION WANTED—By a foreman plater, not a self-styled expert, but a man with executive ability, thorough practical knowledge and twenty-three years' experience upon gold, silver, bright silver, nickel, black nickel, brass, bronze and copper plating, coloring, oxidizing and bronzing upon both soft and hard metals, thoroughly experienced upon silverware, art metal novelties, ecclesiastical goods, casket hardware, builders' hardware, ornamental brass and iron plumbing and bathroom supplies and antimonial lead novelties, familiar with salt water gilding, ormolu gold, French gray and mechanical plating. Can furnish high-grade references. For further information address

HYDROPLASTIC,
Care THE METAL INDUSTRY.

SUPERVISOR

SITUATION WANTED—As supervisor, production manager or general foreman with a reliable concern in any branch of the metal business, by a metallurgical engineer with 15 years' practical experience. Can handle labor, cost and production difficulties efficiently. Expert on refining, casting, forging, extruding, drawing, rolling and stamping all metals. Experienced in machine practice and chemical analysis. Permanent connection more desirable than large salary. Address:
PERMANENT, Care THE METAL INDUSTRY.

COPPER ROD MILL FOREMAN

SITUATION WANTED—By foreman with twenty years' experience rolling copper and brass rods. Six years as foreman with first-class production record. Can go anywhere in U. S. or Canada. Age 38, married, and want permanent place. Address:

ROD MILL,
Care THE METAL INDUSTRY.

ELECTRO-PLATERS

Anyone desiring the services of first class men for the electro-deposition of metals and finishing in all branches and departments of the plating business can secure such services by corresponding with the Secretary of the American Electro-Platers Society.

JOHN E. STERLING,
468 Grand Avenue, Long Island City, N. Y.

ETCHER

SITUATION WANTED—By an expert etcher, who thoroughly understands the best and up-to-date methods. Can teach any branch of the art in a few days' time and supply all formulas, etc. Address

SIMPLE METHODS,
Care THE METAL INDUSTRY.

A PARTIAL LIST OF THE PRINCIPAL ARTICLES PUBLISHED IN THE METAL INDUSTRY DURING 1921

MANUFACTURING

FOUNDING

METALLURGICAL

ROLLING

PLATING, POLISHING AND FINISHING

BUSINESS AND MANAGEMENT

BUYERS' GUIDE: ADVERTISERS' PRODUCTS

ABRASIVES (Also see Emery.)
Artificial
General Abrasive Co., Niagara Falls, N. Y.
Picotte, P. E., Co., Inc., New York.
Stevens, Frederic B., Detroit, Mich.
White Heat Products Co., West Chester, Pa.
Polishing
White Heat Products Co., West Chester, Pa.

ABRASIVE DISCS
White Heat Products Co., West Chester, Pa.

ABRASIVES FOR CLOTH, PAPER, ETC.
White Heat Products Co., West Chester, Pa.

ACID-PROOF STONEWARE (See Acid Pumps; Dipping Baskets.)

ACID PUMPS, STONEWARE
General Ceramics Co., New York.

ACIDS
Hydrofluoric
General Chemical Co., Philadelphia, Pa.
Oil of Vitriol (Sulphuric.)
Du Pont, E. I., de Nemours & Co., Wilmington, Del.
Hegeler Zinc Co., Danville, Ill.
New Jersey Zinc Co., New York.
Sulphuric
Du Pont, E. I., de Nemours & Co., Wilmington, Del.

ACCUMULATORS, HYDRAULIC (Also see Hydraulic Machinery.)
Watson-Stillman Co., New York.

AEROPLANE DOPE
Du Pont, E. I., de Nemours & Co., Wilmington, Del.
Egyptian Lacquer Mfg. Co., New York.
Nikolas, G. J., Co., Chicago, Ill.
Zeller Lacquer Mfg. Co., Inc., New York.

AIR AND VARNISH HEATERS
Eureka Pneumatic Spray Co., New York.

AIR BRUSHES AND ACCESSORIES (See Sprayers; Spraying Accessories.)

AIR COMPRESSORS (Also see Centrifugal Air and Gas Compressors.)
DeVilbiss Mfg. Co., Toledo, O.
Eclipse Air Brush Co., Newark, N. J.
Eureka Pneumatic Spray Co., New York.
New Haven Sand Blast Co., New Haven, Conn.
Nikolas, G. J., Co., Chicago, Ill.
Universal Sprayer Co., New York.

AIR FILTERS
De Vilbiss Mfg. Co., Toledo, Ohio.
Eureka Pneumatic Spray Co., New York.
Nikolas, G. J., Co., Chicago, Ill.

AIR SCRUBBERS
Eureka Pneumatic Spray Co., New York.

AIR TANKS
Eureka Pneumatic Spray Co., New York.
Nikolas, G. J., Co., Chicago, Ill.

AIR AND GAS PRE-MIXING BURNERS (See Burners.)

ALLOYS (See Kind Wanted.)

ALUMINUM (See Angles and Channels; Castings; Die Castings; Electrical Conductors; Fluxes; Forgings; Granulated Metals; Ingots; Leaf and Foil; Machined Products; Match Plates; Moldings and Extruded Shapes; Pipe; Powder; Rods and Bars; Sheets; Solder; Strip Metal; Tubes; Wire, Etc.)

ALUMINUM ALLOYS
American Boron Products Co., Reading, Pa.
Electric Smelting & Aluminum Co., Lockport, N. Y.
Great Western Smelting & Refining Co., St. Louis, Mo.

AMMETERS (See also Electrical Apparatus and Equipment.)
Connecticut Dynamo & Motor Co., Irvington, N. J.
Crown Rheostat & Supply Co., Chicago, Ill.

AMMONIUM CHLORIDE
Roessler & Hasslacher Chemical Co., New York.

AMYL ACETATE
Du Pont, E. I., de Nemours & Co., Wilmington, Del.
Egyptian Lacquer Mfg. Co., New York.
Nikolas, G. J., Co., Chicago, Ill.
Zeller Lacquer Mfg. Co., Inc., New York.

ANNEALING FURNACES
Oil or Gas
Kenworthy, Chas. F., Waterbury, Conn.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Surface Combustion Co., New York.

ANODES
Brass and Bronze
Apothecaries Hall Co., Waterbury, Conn.
Bennett-O'Connell Company, Chicago, Ill.
General Platers' Supply Co., New York.
Hanson & Van Winkle Co., Newark, N. J.
Harshaw, Fuller & Goodwin Co., Cleveland, O.
Munning, A. P., & Co., New York-Chicago.
National Metal Products Co., Athenia, N. J.
Rome Brass and Copper Co., Rome, N. Y.
Stevens, Frederic B., Detroit, Mich.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.
Copper
Harshaw, Fuller & Goodwin Co., Cleveland, O.
Hussey, C. G., & Co., Pittsburgh, Pa.
Munning, A. P., & Co., New York-Chicago.
Rome Brass and Copper Co., Rome, N. Y.
National Metal Products Co., Athenia, N. J.
Stevens, F. B., Detroit, Mich.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.
Gold
Handy & Harman, New York.
Nickel
Apothecaries Hall Co., Waterbury, Conn.
Bennett-O'Connell Company, Chicago, Ill.
Crown Rheostat & Supply Co., Chicago, Ill.
Ely, C. Upham, New York.
General Platers' Supply Co., New York.
Hanson & Van Winkle Co., Newark, N. J.
Harshaw, Fuller, & Goodwin Co., Cleveland, O.
Kyle, Geo. W., Company, New York.
Munning, A. P., & Co., New York-Chicago.
National Metal Products Co., Athenia, N. J.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.
Platinum
Handy & Harman, New York.
Roessler & Hasslacher Chemical Co., New York.
Silver
Goldsmith Bros. Smelting & Refining Co., Chicago, Ill.
Handy & Harman, New York.
Jackson, John J., Co., Newark, N. J.
Zinc
Bennett-O'Connell Company, Chicago, Ill.
Hanson & Van Winkle Co., Newark, N. J.
Harshaw, Fuller & Goodwin Co., Cleveland, O.
Munning, A. P., & Co., New York-Chicago.
New Jersey Zinc Co., New York.

ANTI-FRICTION METAL (Also see Babbitt Metal, and Bearings.)

ANTIMONY METAL
Leavitt, C. W., & Co., New York.

ASSAY CRUCIBLES
Sand
Joseph Dixon Crucible Company, Jersey City, N. J.

ASSAYERS AND CHEMISTS (See also Testing Laboratories.)
Pitkin, Lucius, Inc., New York.

AUTOMATIC MACHINERY (See Bolt Heading, Trimming & Threading Machines; Buffing Machines; Cock Grinders; Cutting, Straightening and Forming Machines; Drying-out Machines; Dipping Baskets; Drop Lifters; Pickling Machines; Polishing Machines; Washing Machines.)

AUTOMATIC POLISHING MACHINES
Acme Mfg. Co., Detroit, Mich.
Excelsior Tool & Machine Co., E. St. Louis, Ill.

AUTOMATIC WIRE AND SHEET METAL WORKING MACHINERY
Baird Machine Co., Bridgeport, Conn.

AUTOMOBILE FORGINGS (Also see Forgings.)
American Manganese Bronze Co., Holmesburg, Philadelphia, Pa.

BABBITT METAL (See also Bearings.)
Ajax Metal Co., Philadelphia, Pa.
American Manganese Bronze Co., Holmesburg, Philadelphia, Pa.
Electric Smelting & Aluminum Co., Lockport, N. Y.
Frictionless Metal Co., Chattanooga, Tenn.
Michigan Smelting & Refining Co., Detroit, Mich.

BABBITT MOLDS (See Molds.)

BALL BURNISHING EQUIPMENT (Also see Burnishing and Polishing Barrels.)
Abbott Ball Co., Hartford, Conn.
Baird Machine Co., Bridgeport, Conn.
No-Dust Drying Machine Co., Providence, R. I.

BALLS, STEEL (See Steel Balls.)

BARS; SILVER, GOLD, PLATINUM
Handy & Harman, New York.

BEARINGS (Also see Babbitt Metal and Anti-Friction Metal.)
Babbitt
Ajax Metal Co., Philadelphia, Pa.
Frictionless Metal Co., Chattanooga, Tenn.

BINS AND RACKS, STEEL
Lupton's, David, Sons Co., Philadelphia, Pa.

BLOWERS AND BLOW PIPING (See also Exhaust Fans and Heads.)
Astle, H. J., & Co., Providence, R. I.
Cleveland Blow Pipe & Mfg. Co., Cleveland, Ohio.
Monarch Engineering & Mfg. Co., Baltimore, Md.
New Haven Sand Blast Co., New Haven, Conn.

BLOWERS, HIGH PRESSURE
Leiman Bros., New York.

BOILER INSULATION (See Brick, Insulating; Insulation, Boiler; Insulating Cement.)

BOILER SETTING (See Fire Cement.)

BOLT, SCREW AND NUT MACHINERY
Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.

BORONIC ALLOYS
American Boron Products Co., Reading, Pa.

BOTTOM PLATES, STEEL
Wadsworth Core Machine & Equipment Co., Akron, O.

BRASS (See Brass Mill Products; Wire Mill Products; Anodes; Briquet Ingots; Castings; Die Castings; Discs and Cups; Forgings; Ingots, Moldings and Extruded Shapes; Rods and Bars; Sheets; Strip Metal; Tubes; Wire.)

BRASS FOUNDERS (See Castings.)

BRASS FOUNDRY EQUIPMENT & SUPPLIES (See Kind Wanted.)

BRASS MILL ENGINEERS (See Engineers.)

BRASS MILL MACHINERY (Also See Kind Wanted.)
Garrison, A., Foundry Co., Pittsburgh, Pa.
Sundh Engineering & Machine Co., Philadelphia, Pa.

BRASS MILL PRODUCTS
Western Cartridge Co., East Alton, Ill.
Baltimore Brass Co., Baltimore, Md.

BRASS; SHEET WIRE; ROD, TUBE (Also see Wire Mill Products; Rods and Bars; Sheets; Strip Metals; Tubes; Wire, Etc.)
American Brass Company, Waterbury, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
Bristol Brass Co., Bristol, Conn.
Chase Metal Works, Waterbury, Conn.
Dallas Brass & Copper Co., Chicago, Ill.
Dueber Watch Case Mfg. Co., Canton, O.
Hendricks Bros., New York.
Manhattan Brass Co., New York.
Rome Brass and Copper Co., Rome, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
Seymour Mfg. Co., Seymour, Conn.
Taunton-New Bedford Copper Co., Taunton, Mass.
Wheeler Condenser & Engineering Co., Carteret, N. J.

BRASS MOLDERS FLASKS (See Flasks.)

BRASS WORKING LATHES (See Lathes.)

BRAZING SOLDER (See Solder.)

BUYERS' GUIDE: ADVERTISERS' PRODUCTS

BRICK (Also see Fire Brick.)

Insulating

Armstrong Cork & Insulation Co., Pittsburgh, Pa.
Quigley Furnace Specialties Co., New York.

BRITANNIA METAL

Standard Rolling Mills Inc., Brooklyn, N. Y.

BRONZE (See Anodes; Castings; Die Castings; Forgings; Ingots; Powder; Rods and Bars; Tubes; Etc.)

BRONZING LIQUID

Du Pont, E. I., de Nemours & Co., Wilmington, Del.
Egyptian Lacquer Mfg. Co., New York.
Nikolas, G. J., Co., Chicago, Ill.
Waukegan Chemical Co., Waukegan, Ill.
Zeller Lacquer Mfg. Co., New York.

BRUSHES

Hand

Blumenthal, H., & Co., New York.
Egyptian Lacquer Mfg. Co., New York.
Gornell, E., & Sons, Chicago, Ill.
Munning, A. P., & Co., New York-Chicago.
Nikolas, G. J., Co., Chicago, Ill.
Paxson, J. W., Co., Philadelphia, Pa.

Wheel

Blumenthal, H., & Co., New York.
Gornell, E., & Sons, Chicago, Ill.
Hanson & Van Winkle Co., Newark, N. J.
Munning, A. P., & Co., New York-Chicago.

BUFFING CAKE, PLATINUM (See Buffing and Polishing Compositions.)

BUFFING MACHINES, AUTOMATIC (Also see Polishing Lathes and Heads.)

Acme Mfg. Co., Detroit, Mich.
Divine Bros. Co., Utica, N. Y.

BUFFING AND POLISHING COMPOSITIONS

Apothecaries Hall Co., Waterbury, Conn.
Bennett-O'Connell Supply Co., Chicago, Ill.
Burns, B. Reed, Supply Co., Brooklyn, N. Y.
Crown Rheostat & Supply Co., Chicago, Ill.
General Platers' Supply Co., New York.
Hanson & Van Winkle Co., Newark, N. J.
Harshaw, Fuller & Goodwin Co., Philadelphia, Pa.
Kyle, Geo. W., Company, New York.
Munning, A. P., & Co., New York-Chicago.
Oden Corporation, Whitestone, L. I., N. Y.
Picotte, P. E., Co., Inc., New York.
Stevens, Frederic B., Detroit, Mich.
Warren Products Co., New York.
Wiarda, John C., & Co., Brooklyn, N. Y.
Williamsville Buff Mfg. Co., Danielson, Conn.

BUFFING AND POLISHING WHEELS (Also see Buffs.)

Canvas, Cotton, Etc.

Bennett-O'Connell Co., Chicago, Ill.
Bias Buff & Wheel Co., Jersey City, N. J.
Crown Rheostat & Supply Co., Chicago, Ill.
Divine Bros Co., Utica, N. Y.
Eastern Felt Co., Winchester, Mass.
General Platers' Supply Co., New York.
Hanson & Van Winkle Co., Newark, N. J.
Kyle, Geo. W., Company, New York.
Milton Mfg. Co., Syracuse, N. Y.
Munning, A. P., & Co., New York-Chicago.
Picotte, P. E., Co., Inc., New York.
Warren Products Co., New York.
Williamsville Buff Mfg. Co., Danielson, Conn.

Felt

Divine Bros. Co., Utica, N. Y.
Eastern Felt Co., Winchester, Mass.
Hanson & Van Winkle Co., Newark, N. J.

Sheepskin

Yorkville Mfg. Co., Brooklyn, N. Y.

BUFFS (Also see Buffing and Polishing Wheels.)

Bennett-O'Connell Co., Chicago, Ill.
Bias Buff & Wheel Co., Jersey City, N. J.
Burns, B. Reed, Supply Co., Brooklyn, N. Y.
Crown Rheostat & Supply Co., Chicago, Ill.
Divine Bros. Co., Utica, N. Y.
General Platers' Supply Co., New York.
Hanson & Van Winkle Co., Newark, N. J.
Kyle, Geo. W., Company, New York.
Milton Mfg. Co., Syracuse, N. Y.
Munning, A. P., & Co., New York-Chicago.
Oden Corporation, Whitestone, L. I., N. Y.
Picotte, P. E., Co., Inc., New York.
Warren Products Co., New York.
Williamsville Buff Mfg. Co., Danielson, Conn.

BUILDING PAINT SPRAYERS

DeVilbiss Mfg. Co., Toledo, O.

BURNERS (Also see Furnaces.)

Air and Gas Pre-Mixing

Maxon Furnace & Engineering Co., Muncie, Ind.
Monarch Engineering & Mfg. Co., Baltimore, Md.

Oil or Gas

Campbell Hausfeld Co., Harrison, Ohio.

BURNISHING AND POLISHING BARRELS

Abbott Ball Co., Hartford, Conn.
Baird Machine Co., Bridgeport, Conn.
Crown Rheostat & Supply Co., Chicago, Ill.
Globe Machine & Stamping Co., Cleveland, O.
Henderson Bros Co., Waterbury, Conn.
No-Dust Drying Machine Co., Providence, R. I.
Smith-Richardson Co., Attleboro, Mass.

BURNISHING COMPOUNDS AND CHIPS (Also see Soap.)

Abbott Ball Co., Hartford, Conn.
International Chemical Co., Philadelphia, Pa.

BUTYL ACETATE

Zeller Lacquer Mfg. Co., Inc., New York.

CABBAGING PRESSES (See Presses; Scrap Baling Machines.)

CALCIUM-COPPER (See Ingots.)

CANVAS WHEELS (See Buffing and Polishing Wheels.)

CASE HARDENING MATERIALS

Buchanan, C. G., Chemical Co., Cincinnati, O.

CASTINGS

Aluminum

Light Mfg. & Foundry Co., Pottstown, Pa.

Brass, Bronze and Composition

American Manganese Bronze Co., Holmesburg, Philadelphia, Pa.

Copper

National Metal Products Co., Athenia, N. J.

Nichrome

Driver-Harris Co., Harrison, N. J.

Zinc

New Jersey Zinc Co., New York.

CAUSTICIZED ASH

Solvay Process Co., Syracuse, N. Y.

CAUSTIC SODA

Harshaw, Fuller & Goodwin Co., Philadelphia, Pa.
International Chemical Co., Philadelphia, Pa.
Roessler & Hasslacher Chemical Co., New York.
Solvay Process Co., Syracuse, N. Y.

CEMENT (See Fire Cement; Insulating Cement.)

CENTRIFUGAL DRYERS AND EXTRACTORS (Also see Drying-Out Machines.)

Tolhurst Machine Works, Troy, N. Y.

CHEMICALS, DEALERS IN ALL KINDS (Also see Kind Wanted.)

Bennett-O'Connell Company, Chicago, Ill.
Cooper, Charles, & Company, New York.
Harshaw, Fuller & Goodwin Co., Philadelphia, Pa.

CHEMISTS, CONSULTING (See Assayers and Chemists; Testing Laboratories.)

CHLORIDE OF IRON

Roessler & Hasslacher Chemical Co., New York.

CHUCKS, SPINNING, ROUND & OVAL

Pryibil, P., Machine Co., New York.

CINDER CRUSHERS (See Crushers and Pulverizers; Reclaiming Machinery.)

CLEANERS, METAL, WASTE, GENERAL

International Chemical Co., Philadelphia, Pa.
Oakley Chemical Co., New York.

CLEANING APPARATUS, AUTOMATIC METAL (Also see Pickling Machines.)

Sundh Engineering & Machine Co., Philadelphia, Pa.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.

CLEANING COMPOUNDS (See also Fig Cleanser; Pickling Compounds, Whale Oil Soaps.)

Metal

Anthony, H. M., Co., New York.
Apothecaries Hall Co., Waterbury, Conn.
Bennett-O'Connell Co., Chicago, Ill.
Electric Smelting & Aluminum Co., Lockport, N. Y.
Ford, J. B., Co., Wyandotte, Mich.
Fuller, W. A., Co., Greensburg, Pa.
General Platers' Supply Co., New York.
Hanson & Van Winkle Co., Newark, N. J.
International Chemical Co., Philadelphia, Pa.
Munning, A. P., & Co., New York-Chicago.
Oakley Chemical Co., New York.
Picotte, P. E., Co., Inc., New York.
S. H. Chemical Co., Boston, Mass.
Solvay Process Co., Syracuse, N. Y.
Stevens, Frederic B., Detroit, Mich.

COCK GRINDERS, AUTOMATIC

Turner Machine Co., Philadelphia, Pa.

COMPOSITION METAL (See Castings; Ingot, Etc.)

COMPOSITIONS (See Buffing and Polishing Compositions; Flooring Compositions.)

COMPOUNDS, CUTTING AND GRINDING, DRAWING, STAMPING

International Chemical Co., Philadelphia, Pa.
Oakley Chemical Co., New York.

COMPRESSORS, AIR & GAS (See Air Compressors.)

CONCENTRATING TABLES (See Reclaiming Machinery.)

CONCENTRATORS, MAGNETIC

Dings Magnetic Separator Co., Milwaukee, Wis.

CONTRACT WORK (See Castings; Die-Castings; Dies; Electro-Galvanizing, Electro-Plating; Forgings; Hot Galvanizing and Tinning; Plating; Barrel Method; Polishing and Burnishing; Etc.)

CONVEYOR MAGNETS

Dings Magnetic Separator Co., Milwaukee, Wis.

COPPER (Also see Anodes; Castings; Ingots; Rods and Bars; Sheets; Smelters and Refiners; Strip Metal; Tubes; Wire; Etc.)

Sheet, Wire, Rod, Tube

American Brass Co., Waterbury, Conn.
Rome Brass and Copper Co., Rome, N. Y.
Wheeler Condenser & Engineering Co., Carteret.

COPPER-ALUMINUM, BORONIC

American Boron Products Co., Reading, Pa.

COPPER BEARING MATERIAL, BUYERS OF (Also see Drosses, Residues, Etc.)

COPPER, BORONIC

American Boron Products Co., Reading, Pa.

COPPER, CARBONATE OF

Cooper, Chas., & Co., New York.
Crown Rheostat & Supply Co., Chicago, Ill.
Wiarda, John C., Co., Brooklyn, N. Y.

COPPER-CLAD WIRE, ROD, ETC. (See Wire.)

COPPER-CYANIDE

Middlesex Aniline Co., Lincoln, N. J.
Roessler & Hasslacher Chemical Co., New York.

COPPER-NICKEL, BORONIC

American Boron Products Co., Reading, Pa.

CORE MACHINES

Stevens, Frederic B., Detroit, Mich.
Wadsworth Core Machine & Equipment Co., Akron, Ohio.

CORE OILS AND COMPOUNDS

Stevens, Frederic B., Detroit, Mich.

CORE OVEN INSULATION (See Brick, Insulating; Insulating Cement; Insulation Oven.)

CORE OVENS

Coal and Coke

Monarch Engineering & Mfg. Co., Baltimore, Md.
Steiner, E., & Co., Newark, N. J.
Stevens, Frederic B., Detroit, Mich.
Wadsworth Core Machine & Equipment Co., Akron, O.

Oil and Gas

Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Wadsworth Core Machine & Equipment Co., Akron, O.

CORE TRAYS, STEEL

Wadsworth Core Machine & Equipment Co., Akron, O.

COUPLES

Dixon, Joseph, Crucible Co., Jersey City, N. J.

BUYERS' GUIDE: ADVERTISERS' PRODUCTS

CRANES, HAND, POWER AND ELECTRIC TRAVELING
Northern Engineering Works, Detroit, Mich.

CRUCIBLES, GRAPHITE
Bartley, Jonathan, Crucible Co., Trenton, N. J.
Dixon, Joseph, Crucible Co., Jersey City, N. J.
Gautier, J. H., & Co., Jersey City, N. J.
General Platers' Supply Co., New York.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Ross-Tacony Crucible Co., Tacony, Philadelphia, Pa.
Seidel, R. B., Inc., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Taylor, Robt. J., Inc., Philadelphia, Pa.
Warren Products Co., New York.
Waterbury Mfg. Co., Waterbury, Conn.

CRUCIBLE TONGS (See Tongs.)

CRUSHER PROTECTORS
Dings Magnetic Separator Co., Milwaukee, Wis.

CRUSHERS AND PULVERIZERS (See also Reclaiming Machinery.)
Eastern Machinery Co., New Haven, Conn.
Standard Equipment Co., New Haven, Conn.

CUPRO-NICKEL (See Brass Mill Products.)

CUTTING, STRAIGHTENING & FORMING MACHINERY
Wire
Baird Machine Co., Bridgeport, Conn.
Shuster, F. B., Co., New Haven, Conn.
Strip Metal
Baird Machine Co., Bridgeport, Conn.
Bliss, E. W., Co., Brooklyn, N. Y.
Shuster, F. B., Co., New Haven, Conn.

CYANIDE (See also Copper-Cyanide; Silver Cyanide; Cyanide; Sodium Cyanide; Zinc Cyanide.)
Crown Rheostat & Supply Co., Chicago, Ill.

DEOXIDIZERS, METAL (See Fluxes.)

DESIGNS, FLATWARE & HOLLOWWARE
Shelton Tool & Machine Co., Derby, Conn.

DIE-CASTING (Also see Castings, Die.)
White Metal
Light Mfg. & Foundry Co., Pottstown, Pa.

DIES
Sheet Metal Working
Bliss, E. W., Co., Brooklyn, N. Y.
Ornamental Forging & Blanking
Shelton Tool & Mach. Co., Derby, Conn.

DIPPING BASKETS
Automatic
U. S. Electro Galvanizing Co., Brooklyn, N. Y.
Heat-Resisting
Driver-Harris Co., Harrison, N. J.
Stoneware
Bennett-O'Connell Company, Chicago, Ill.
General Ceramics Co., New York.
Wire
Bennett-O'Connell Company, Chicago, Ill.
Smith, John P., & Co., New Haven, Conn.

DOORS AND PARTITIONS, STEEL
Lupton's, David, Sons Co., Philadelphia, Pa.

DRAW BENCHES
Wire, Rod, Tube
Watson-Stillman Co., New York.
Light Wire
Leiman Bros., New York.

DRAWING AND STAMPING (See Metal Goods Made to Order; Stamping and Drawing.)

DRILLING MACHINES, LIGHT, SENSITIVE
Leiman Bros., New York.

DRINKING WATER SUPPLY SYSTEMS
Armstrong Cork & Insulation Co., Pittsburgh, Pa.

DROP HAMMERS
Bliss, E. W., Co., Brooklyn, N. Y.

DROP LIFTERS (See also Presses, Drop Lifters for.)
Automatic
Miner & Peck Mfg. Co., Derby, Conn.

DROSSES, RESIDUES, ETC., BUYERS OF (Also see Metal Dealers, Old.)
Balbach Smelting & Refining Co., Newark, N. J.
Capper, Pass & Son, Ltd., Bristol, England.
Nassau Smelting & Refining Co., New York.

DRUMS, MAGNETIC
Dings Magnetic Separator Co., Milwaukee, Wis.

DRYERS (See Centrifugal Dryers; Ovens; Drying-Out Machines; Ladle Heaters and Dryers; Mold Dryers; Sand Dryers; Sawdust Drying-Out Boxes.)

DRYING-OUT MACHINES (See also Centrifugal Dryers and Extractors; Sawdust Drying-Out Boxes.)
Baird Machine Co., Bridgeport, Conn.
Smith-Richardson Co., Attleboro, Mass.
Automatic
Astle, H. J., & Co., Providence, R. I.
No-Dust Drying Machine Co., Providence, R. I.
Tolhurst Machine Works, Troy, N. Y.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.

DUST ARRESTERS
Pangborn Corporation, Hagerstown, Md.

DUST COLLECTORS AND VENTILATING SYSTEMS (Also see Exhaust Fans and Heads.)
Astle, H. J., & Co., Providence, R. I.
Cleveland Blow Pipe & Mfg. Co., Cleveland, Ohio.
Kirk & Blum Co., Cincinnati, O.
No-Dust Drying Machine Co., Providence, R. I.

DYNAMOS, LOW VOLTAGE, PLATING AND GALVANIZING (Also see Electrical Apparatus and Equipment.)
Bennett-O'Connell Co., Chicago, Ill.
Bogue, Chas. J., Electric Co., New York.
Connecticut Dynamo & Motor Co., Irvington, N. J.
Crown Rheostat & Supply Co., Chicago, Ill.
Eager Electric Co., Watertown, N. Y.
Hanson & Van Winkle Co., Newark, N. J.
Jantz & Leist Electric Co., Cincinnati, O.
Munning, A. P., & Co., New York-Chicago.
Stevens, Frederic B., Detroit, Mich.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.

ELECTRICAL APPARATUS AND EQUIPMENT (Also see Ammeters, Rheostats, Switchboards, Transformers, Voltmeters.)
Bennett-O'Connell Company, Chicago, Ill.
Bogue, Chas. J., Electric Co., New York.

ELECTRIC CRANES (See Cranes.)

ELECTRICAL COPPER
Rome Brass and Copper Co., Rome, N. Y.

ELECTRIC FURNACES
Melting
Ajax Metal Co., Philadelphia, Pa.

ELECTRIC HOISTS (See Hoists.)

ELECTRIC OVENS (See Ovens; also Core Ovens.)

ELECTRO-GALVANIZING, JOB AND CONTRACT
Hassall, John, Inc., Brooklyn, N. Y.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.

ELECTRO GALVANIZING EQUIPMENT AND SUPPLIES (See Dynamos; Plating Barrels; Plating Machines, Automatic; Tanks, etc.)

ELECTRO GALVANIZING MACHINES, AUTOMATIC (See Plating Machines, Automatic.)

ELECTRO PLATING, JOB & CONTRACT (Also see Aluminum, Electro Plating of; Polishing and Burnishing; Plating, Barrel Method.)
Cohan-Epner Co., New York.
Hassall, John, Inc., Brooklyn, N. Y.
Irvington Plating Co., Irvington, N. J.
Sievering, Philip, New York.

ELECTRO PLATING EQUIPMENT AND SUPPLIES (See Kind Wanted.)

EMERY (Also see Abrasives.)
Crown Rheostat & Supply Co., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Williamsville Buff Mfg. Co., Danielson, Conn.

ENAMELING OVENS (See Ovens.)

ENAMELS
Colored
Du Pont, E. I., de Nemours & Co., Wilmington, Del.
Egyptian Lacquer Mfg. Co., New York.
Hilo Varnish Corporation, Brooklyn, N. Y.
Izen Company, Inc., New York.
Maas & Waldstein Co., New York.
Nikolas, G. J., & Co., Chicago, Ill.
Waukegan Chemical Co., Waukegan, Ill.
Zeller Lacquer Mfg. Co., New York.
Lacquer
Apothecaries Hall Co., Waterbury, Conn.
Du Pont, E. I., de Nemours & Co., Wilmington, Del.
Egyptian Lacquer Mfg. Co., New York.
Hilo Varnish Corporation, Brooklyn, N. Y.
Izen Company, Inc., New York.
Maas & Waldstein Co., New York.
Nikolas, G. J., Co., Chicago, Ill.
Waukegan Chemical Co., Waukegan, Ill.
Zeller Lacquer Mfg. Co., New York.
Wood
Du Pont, E. I., de Nemours & Co., Wilmington, Del.
Egyptian Lacquer Mfg. Co., New York.
Hilo Varnish Corporation, Brooklyn, N. Y.
Izen Company, Inc., New York.
Waukegan Chemical Co., Waukegan, Ill.
Zeller Lacquer Mfg. Co., New York.

ENAMEL SPRAYERS (See Sprayers.)

ENGINEERS
Fuel
Maxon Furnace & Engineering Co., Muncie, Ind.
Furnace
Kenworthy, Chas. F., Waterbury, Conn.
Maxon Furnace & Engineering Co., Muncie, Ind.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Quigley Furnace Specialties Co., New York.
Industrial
McDonald-Churchill Corporation, New York.
Polishing and Grinding
Divine Bros. Co., Utica, N. Y.

ESCUTCHEON PINS, ALL METAL
Hassall, John, Inc., Brooklyn, N. Y.

EXHAUST BOOTHS AND BENCHES FOR LACQUERS
Eureka Pneumatic Spray Co., New York.

EXHAUST FANS AND HEADS (Also see Blowers and Blow Piping; Dust Collectors and Ventilating Systems.)
Cleveland Blow Pipe & Mfg. Co., Cleveland, Ohio.

EXHAUST WHEELS, ROLLER BEARING, BELT AND MOTOR DRIVEN
Eureka Pneumatic Spray Co., New York.

ETHYL ACETATE
Du Pont, E. I., de Nemours & Co., Wilmington, Del.
Nikolas, G. J., & Co., Chicago, Ill.
Zeller Lacquer Mfg. Co., Inc., New York.

EXTRUDED MOLDINGS AND SHAPERS (See Moldings, Etc.)

EXTRUDED SHAPES
Brass, Copper and Bronze
Rome Brass and Copper Co., Rome, N. Y.

EYELET MACHINES
Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.

FACINGS (See Foundry Facings.)

FELT POLISHING WHEELS (Also see Buffing and Polishing Wheels.)
Crown Rheostat & Supply Co., Chicago, Ill.
Divine Bros. Co., Utica, N. Y.
Eastern Felt Co., Winchester, Mass.
Picotte, P. E., Co., Inc., New York.

BUYERS' GUIDE: ADVERTISERS' PRODUCTS

FELT SHEETS
American Felt Co., Boston, Mass.
Eastern Felt Co., Winchester, Mass.

FIG CLEANERS (Also See cleaning Compounds, Whale Oil Soap.)
International Chemical Co., Philadelphia, Pa.

FILM COATINGS
Waukegan Chemical Co., Waukegan, Ill.

FILTER, TANK
Belkes Perfect Tank Filter, Chicago, Ill.

FILTER SYSTEM FOR PLATING SOLUTIONS
Belkes Perfect Tank Filter, Chicago, Ill.

FILTERING, AERATING AND AGITATING SYSTEM
Belkes Perfect Tank Filter, Chicago, Ill.

FIRE CEMENT
Campbell-Hausfeld Co., Harrison, Ohio.
Crescent Refractories Co., Curwensville, Pa.
Dixon, Joseph, Crucible Co., Jersey City, N. J.
Pecora Paint Co., Philadelphia, Pa.
Quigley Furnace Specialties Co., New York.

FIRE EXTINGUISHERS
American La-France Fire Engine Co., Inc., Elmira, N. Y.

FIRE EQUIPMENT
American La-France Fire Engine Co., Inc., Elmira, N. Y.

FIRST AID EQUIPMENT & SUPPLES
American La-France Fire Engine Co., Inc., Elmira, N. Y.

FLOORING COMPOSITION
Armstrong Cork & Insulation Co., Pittsburgh, Pa.

FLUXES
Metal Melting
American Boron Products Co., Reading, Pa.

FORGINGS (Also see Automobile Forgings.)
Brass and Bronze
Scovill Mfg. Co., Waterbury, Conn.

FOUNDRY EQUIPMENT AND SUPPLIES (See Kind Wanted.)

FOUNDRY ENGINEERS (See Engineers.)

FOUNDRY FACINGS
Dixon, Joseph, Crucible Co., Jersey City, N. J.
Paxson, J. W., Co., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.

FOUNDRY RIDDLES (See Sand Sifters.)

FOUNDRY SPRAYERS (See Sprayers.)

FUEL OIL, FURNACES
Wayne Oil Tank & Pump Co., Ft. Wayne, Ind.
Oil or Gas
Campbell-Hausfeld Co., Harrison, Ohio.
Gehnrich Indirect Heat Oven Co., Long Island City, N. Y.
Hawley Down-Draft Furnace Co., Easton, Pa.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Rockwell, W. S., Co., New York.
Surface Combustion Co., New York.

FURNACE CEMENT (See Fire Cement.)

FURNACE ENGINEERS (See Engineers.)

FURNACE INSULATION (See Brick, Insulating; Insulating Cement; Insulation, Furnace.)

FURNACES (See Annealing Furnaces; Burners; Electric Furnaces; Galvanizing & Tinning Furnaces; Heat Treating Furnaces; Melting Furnaces; Powdered Coal Burning Furnaces; Smelting Furnaces.)

FURNACE TILE AND LININGS (Also see Fire Brick.)
Crescent Refractories Co., Curwensville, Pa.
Monarch Engineering & Mfg. Co., Baltimore, Md.

FUSEL OIL
Nikolas, G. J., & Co., Chicago, Ill.

GALVANIZING (See also Electric Galvanizing, Job, and Contract; Hot Galvanizing, Job and Contract.)
New Jersey Zinc Co., New York.

GALVANIZING AND TINNING FURNACES (Also see Burners.)
Monarch Engineering & Mfg. Co., Baltimore, Md.

GALVANIZING EQUIPMENT AND SUPPLIES (See Kinds Wanted. Also Plating and Galvanizing Barrels; Plating and Galvanizing Machines, Automatic; Hot Galvanizing and Tinning Equipment.)

GAS BURNERS (See Burners.)

GAS MASKS
American La-France Fire Engine Co., Inc., Elmira, N. Y.

GATE CUTTERS (See Saws; Sprue Cutters.)

GENERATORS (See Dynamos; Motor-Generator Sets.)

GLUE FOR POLISHING
Divine Bros. Co., Utica, N. Y.

GLUE HEATERS AND POTS
Divine Bros. Co., Utica, N. Y.

GOGGLES
American-La France Fire Engine Co., Inc., Elmira, N. Y.

GOLD (See Anodes; Bars; Metal Dealers; Smelters and Refiners.)

GOLD BORONIC
American Boron Products Co., Reading, Pa.

GRAPHITE PRODUCTS, PHOSPHORIZERS, STIRRERS, ETC. (Also see Crucibles.)
Bartley, Jonathan, Crucible Co., Trenton, N. J.
Dixon, Joseph, Crucible Co., Jersey City, N. J.
Gautier, J. H., & Co., Jersey City, N. J.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Ross-Tacony Crucible Co., Tacony, Philadelphia, Pa.
Seidel, H. B., Inc., Philadelphia, Pa.
Taylor, Robt. J., Inc., Philadelphia, Pa.

GRINDING MACHINES
Connecticut Dynamo & Motor Co., Irvington, N. J.
Stevens, Frederic B., Detroit, Mich.

GRINDING WHEEL HOODS (See Dust Collectors and Ventilating Systems; Hoods.)

HOISTS (Also see Cranes.)
Air, Chain, Electric, Pneumatic, Hydraulic
Northern Engineering Works, Detroit, Mich.

HOODS (Also see Dust Collectors and Ventilating Systems.)
Polishing and Grinding Wheel
Cleveland Blow Pipe & Mfg. Co., Cleveland, Ohio.
Kirk & Blum Co., Cincinnati, Ohio.
Spraying
Cleveland Blow Pipe & Mfg. Co., Cleveland, Ohio.
De Vilbiss Mfg. Co., Toledo, Ohio.
Eclipse Air Brush Co., Newark, N. J.

HOT GALVANIZING AND TINNING EQUIPMENT (See Burners; Galvanizing and Tinning Furnaces; Kettles; Tanks.)

HOT TINNING (See Hot Galvanizing and Tinning.)

HOT TINNING SUPPLIES (See Hot Galvanizing and Tinning Equipment.)

HYDRAULIC MACHINERY, PRESSES, JACKS, ETC. (Also see Accumulators; Presses.)
Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.
Watson-Stillman Co., New York.

INGOT MOLDS (See Molds.)

INGOTS (Also see Calcium-Copper; Manganese-Copper; Phosphor-Copper; Phosphor-Tin; Silicon-Copper; Smelters and Refiners.)
Aluminum
British Aluminum Co., New York and Toronto, Ontario.
Electric Smelting & Aluminum Co., Lockport, N. Y.
Great Western Smelting & Refining Co., St. Louis, Mo.
Aluminum Bronze
Electric Smelting & Aluminum Co., Lockport, N. Y.
Brass, Bronze and Composition
Ajax Metal Co., Philadelphia, Pa.
Henning, V., & Sons, Brooklyn, N. Y.
Whipple & Choate Company, Bridgeport, Conn.
Copper
Balbach Smelting & Refining Co., Newark, N. J.
Baltimore Copper Smelting & Rolling Co., Baltimore, Md.
Hendricks Bros., New York.
Trotter, Nathan, & Co., Philadelphia, Pa.
Lead
United Metals Selling Co., New York.
Manganese-Bronze
American Manganese Bronze Co., Holmesburg, Philadelphia, Pa.
Electric Smelting & Aluminum Co., Lockport, N. Y.
Silver Metal
Handy & Harman, New York.
Tin
Baltimore Copper Smelting & Rolling Co., Baltimore, Md.
White Metals
Michigan Smelting & Refining Co., Detroit, Mich.

INSULATING BRICK, BLOCK, POWDER AND CEMENT (See Brick.)

INSULATING CEMENT, HEAT
Armstrong Cork & Insulation Co., Pittsburgh, Pa.

INSULATION (Also see Brick, Insulating; Insulating Cement.)
Boiler
Armstrong Cork & Insulation Co., Pittsburgh, Pa.
Oven
Armstrong Cork & Insulation Co., Pittsburgh, Pa.
Furnace
Armstrong Cork & Insulation Co., Pittsburgh, Pa.
Pipe
Armstrong Cork & Insulation Co., Pittsburgh, Pa.

IRON CASTINGS (See Castings.)

JAPAN REMOVERS
International Chemical Co., Philadelphia, Pa.

JAPANS, ALL KINDS
Du Pont, E. I., de Nemours & Co., Wilmington, Del.
Hilo Varnish Corporation, Brooklyn, N. Y.

JAPANNING BARRELS (See Tumbling Barrels.)

JAPANNING OVENS (See Ovens.)

JEWELERS' BRUSHES (See Brushes.)

JEWELERS' EQUIPMENT (Also see Kind Wanted.)
Leiman Bros., New York.
Smith-Richardson Co., Attleboro, Mass.

BUYERS' GUIDE: ADVERTISERS' PRODUCTS

JEWELERS' ROLLS (See Rolls.)

JEWELERS' SOLDER (See Solders.)

JIGS, FIXTURES, ETC. (See Tools, Jigs, Fixtures.)

LABORATORIES (See Testing Laboratories.)

LACQUERING BARRELS (See Tumbling Barrels.)

LACQUERING, JOB AND CONTRACT
Sievering, Philip, New York.

LACQUER ENAMELS (See Enamels.)

LACQUER OVENS (See Ovens.)

LACQUERS

Colored
Du Pont, E. I., de Nemours & Co., Wilmington, Del.
Egyptian Lacquer Mfg. Co., New York.
Hilo Varnish Corporation, Brooklyn, N. Y.
Isen Company, Inc., New York.
Maas & Waldstein Co., New York.
Nikolas, G. J., Co., Chicago, Ill.
Waukegan Chemical Co., Waukegan, Ill.
Zeller Lacquer Mfg. Co., New York.

For Incandescent Lamps
Egyptian Lacquer Mfg. Co., New York.
Zeller Lacquer Mfg. Co., Inc., New York.

Metal
Apothecaries Hall Co., Waterbury, Conn.
Du Pont, E. I., de Nemours & Co., Wilmington, Del.
Egyptian Lacquer Mfg. Co., New York.
Isen Company, Inc., New York.
Maas & Waldstein Co., New York.
Nikolas, G. J., Co., Chicago, Ill.
Waukegan Chemical Co., Waukegan, Ill.
Zeller Lacquer Mfg. Co., New York.

Wood
Du Pont, E. I., de Nemours & Co., Wilmington, Del.
Egyptian Lacquer Mfg. Co., New York.
Isen Company, Inc., New York.
Waukegan Chemical Co., Waukegan, Ill.
Zeller Lacquer Mfg. Co., New York.

LACQUER REMOVERS
International Chemical Co., Philadelphia, Pa.
Zeller Lacquer Mfg. Co., Inc., New York.

LACQUER SPRAYERS (See Sprayers.)

LADLE HEATERS AND DRYERS
Hawley Down-Draft Furnace Co., Easton, Pa.
Monarch Engineering & Mfg. Co., Baltimore, Md.

LATHES (Also see Polishing Lathes.)

Pattern Makers
Pryibil, P., Machine Co., New York.

Spinning
Bliss, E. W., Co., Brooklyn, N. Y.
Pryibil, P., Machine Co., New York.

LEAD, PIG AND BAR
Baltimore Copper Smelting & Rolling Co., Baltimore, Md.

LEAD-LINED TANKS (See Tanks.)

LEATHER POLISHING WHEELS (See Buffing and Polishing Wheels.)

LEATHER FOR DRY BARREL POLISHING
Peckham Mfg. Co., Newark, N. J.

LOCOMOTIVES, INDUSTRIAL (See Electric Locomotives.)

LUBRICANTS, Cutting and Grinding, Drawing, Stamping.
International Chemical Co., Philadelphia, Pa.
Oakley Chemical Co., New York.

MAGNESIUM METAL

Sheet, Wire, Rod, Ribbon, Powder
Leavitt, C. W., & Co., New York.
Norton Laboratories, New York.

MAGNETIC SEPARATORS (See also Reclaiming Machinery.)
Paxson, J. W., Co., Philadelphia, Pa.

MAGNETS

Electro
Dings Magnetic Separator Co., Milwaukee, Wis.

MANGANESE-BRONZE (See Ingots.)

MANGANESE-COPPER (Also see Ingots.)
Electric Smelting & Aluminum Co., Lockport, N. Y.

MANTLE DIP
Du Pont, E. I., de Nemours & Co., Wilmington, Del.
Nikolas, G. J., Co., Chicago, Ill.
Zeller Lacquer Mfg. Co., Inc., New York.

MELTING FURNACES (Also see Burners; Galvanizing and Tinning Furnaces; Tank Furnaces.)

Coal and Coke
Monarch Engineering & Mfg. Co., Baltimore, Md.

Oil or Gas
Campbell-Hausfeld Co., Harrison, Ohio.
Hawley Down-Draft Furnace Co., Easton, Pa.
Kenworthy, Chas. F., Inc., Waterbury, Conn.
Maxon Furnace & Engineering Co., Muncie, Ind.
Monarch Engineering & Mfg. Co., Baltimore, Md.

Pit
Monarch Engineering & Mfg. Co., Baltimore, Md.
Paxson, J. W., Co., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.

Reverberatory
Hawley Down-Draft Furnace Co., Easton, Pa.
Monarch Engineering & Mfg. Co., Baltimore, Md.

METAL BRIQUETTES (See Briquet-Ingots.)

METAL CLEANERS (See also Cleaning Compounds.)
Ford, J. B., Co., Wyandotte, Mich.
Fuller, W. A., Co., Greensburg, Pa.
International Chemical Co., Philadelphia, Pa.
Oakley Chemical Co., New York.
Solvay Process Co., Syracuse, N. Y.

METAL DEALERS (Also see Drosses, Residues, Etc., Buyers of; Turnings, Chips, Etc., **Buyers of.**)

Gold, Silver, Platinum
Radnai, Josef, New York.
Roessler & Hasslacher Chemical Co., New York.

New Metals
Nassau Smelting & Refining Co., New York.
North Atlantic Metal Corporation, New York.
Trotter, Nathan, & Co., Philadelphia, Pa.

Old Metals
Henning, V., & Sons, Brooklyn, N. Y.
Metal Purchasing Co., New York.

Rare Metals
North Atlantic Metal Corporation, New York.
Radnai, Josef, New York.

Zinc
New Jersey Zinc Co., New York.

METAL GOODS MADE TO ORDER (Also see Stamping and Drawing.)
Galena Mfg. Co., Galena, Ill.
Kenworthy, Charles F., Inc., Waterbury, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Western Cartridge Co., East Alton, Ill.

METALS (See kinds Wanted. Also Metal Dealers.)

METAL RECLAIMING EQUIPMENT (See Concentrating Tables; Crushers and Pulverizers; Magnetic Separators.)

METAL SPINNING, ALL KINDS
Wildeck, Paul L., Newark, N. J.

METALS, PLATED SHEET (See Plated and Polished Sheet Metals; Sheets.)

METALS RARE (See Metal Dealers.)

MILLS, CRUSHING (See Crushers and Pulverizers.)

MIXERS, SWEEPS MIXING MACHINERY

MOLD DRYERS, PORTABLE
Monarch Engineering & Mfg. Co., Baltimore, Md.

MOLDING MACHINES

Hand Operated
Turner Machine Co., Philadelphia, Pa.

Power
Turner Machine Co., Philadelphia, Pa.

MOLDING SAND (See Sand.)

MOLDS

Babbitt and Solder
Schweizer, Chas. K., St. Louis, Mo.

Ingot
Schweizer, Chas. K., St. Louis, Mo.

MOLD SPRAYERS (See Sprayers.)

MOTOR CONTROL EQUIPMENT (See Electrical Apparatus and Equipment.)

MOTORS, ELECTRIC (Also see Electric Apparatus and Equipment.)
Eager Electric Co., Watertown, N. Y.

MOTOR-GENERATOR SETS (Also see Dynamos; Electrical Apparatus and Equipment.)
Bennett-O'Connell Co., Chicago, Ill.
Connecticut Dynamo & Motor Co., Irvington, N. J.
Crown Rheostat & Supply Co., Chicago, Ill.
Eager Electric Co., Watertown, N. Y.
Hanson & Van Winkle Co., Newark, N. J.
Jants & Leist Electric Co., Cincinnati, Ohio.
Munning, A. P., & Co., New York-Chicago.

MUFFLES
Joseph Dixon Crucible Company, Jersey City, N. J.

MUNTZ'S METAL (See Sheets.)

NICHROME HEAT RESISTING ALLOYS (See Castings; Dipping Baskets, Wire.)

NICKEL (See Anodes; Castings; Ingots; Sheets; Wire; Etc.)

NICKEL, BORONIC
American Boron Products Co., Reading, Pa.

NICKEL SALTS
Apothecaries Hall Co., Waterbury, Conn.
Cooper, Chas., & Co., New York.
Crown Rheostat & Supply Co., Chicago, Ill.
Ely, C., Upham, New York.
General Platers' Supply Co., New York.
Hanson & Van Winkle Co., Newark, N. J.
Harshaw, Fuller & Goodwin Co., Cleveland, Ohio.
Munning, A. P., & Co., New York-Chicago.
Roessler & Hasslacher Chemical Co., New York.
Stevens, Frederic B., Detroit, Mich.
Wiarda, John C., & Co., Brooklyn, N. Y.

NICKEL SILVER (See also Brass, Sheets, Wire, Rod, Tube; Castings; Forgings; Sheets; Etc.)

Sheet, Wire, Rod, Tube
American Brass Co., Waterbury, Conn.

OIL BURNERS (See Burners.)

OIL PUMPS (See Oil Storage Systems.)

OIL STORAGE AND PUMPING SYSTEMS
Monarch Engineering & Mfg. Co., Baltimore, Md.

OLD METALS (See Drosses, Residues, Etc., Buyers of; Metal Dealers.)

OVENS (Also see Burners; also Core Ovens.)

Enameling, Lacquering, Japanning
Gehnrich Indirect Heat Oven Co., Long Island City, N. Y.
Steiner, E., & Co., Newark, N. J.

OVEN BURNERS (See Burners.)

OVEN INSULATION (See Brick, Insulating; Insulating Cement; Insulation.)

BUYERS' GUIDE: ADVERTISERS' PRODUCTS

PAINT SPRAYERS (See Sprayers.)

PATTERN SHOP EQUIPMENT (See Lathes; Saws.)

PAVING BRICK, CORK (See Brick.)

PHOSPHOR BRONZE (See Ingots.)

PHOSPHORIZERS (See Graphite Products.)

PHOSPHOR-COPPER (Also see Ingots.)
Electric Smelting & Aluminum Co., Lockport, N. Y.

PHOSPHOR-COPPER, BORONIC
American Boron Products Co., Reading, Pa.

PHOSPHOR-TIN (Also see Ingots.)
Electric Smelting & Aluminum Co., Lockport, N. Y.

PHOSPHOR-TIN, BORONIC
American Boron Products Co., Reading, Pa.

PHOSPHORUS
General Chemical Co., Philadelphia, Pa.

PICKLING COMPOUND (See Cleaning Compounds.)

PICKLING MACHINES, AUTOMATIC
No-Dust Drying Machine Co., Providence, R. I.
Sundh Engineering & Machine Co., Philadelphia, Pa.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.

PIPE AND BOILER COVERINGS, STEAM, ICE WATER, BRINE (See also Insulation.)

PLATED AND POLISHED SHEET METALS (See also Sheets.)
American Nickeloid Co., Peru, Ill.
Apollo Metal Works, La Salle, Ill.
National Sheet Metal Co., Peru, Ill.

PLATERS' BRUSHES (See Brushes.)

PLATERS' COMPOUND (See Whale Oil Soap.)

PLATING AND GALVANIZING BARRELS
Bennett-O'Connell Co., Chicago, Ill.
Connecticut Dynamo & Motor Co., Irvington, N. J.
Hanson & Van Winkle Co., Newark, N. J.
Munning, A. P., & Co., New York-Chicago.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.

PLATING AND GALVANIZING MACHINES, AUTOMATIC (Also see Plating Barrel.)
Hanson & Van Winkle Co., Newark, N. J.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.

PLATING, BARREL METHOD, JOB AND CONTRACT (Also see Electroplating.)
Sievering, Philip, New York.

PLATING EQUIPMENT AND SUPPLIES (See Kind Wanted.)

PLATING SOLUTION FILTER SYSTEMS
Belkes Perfect Tank Filter, Chicago, Ill.

PLATINUM (See Smelters and Refiners; Anodes; Bars; Metal Dealers; Sheets; Etc.)

PLATINUM BUFFING CAKE (See Buffing and Polishing Compositions.)

PLATINUM SCRAP (See Metal Dealers.)

PLUMBAGO (See Graphite Products.)

POLISHING BARRELS (See Burnishing Barrels.)

POLISHING BELTS, ENDLESS
Ames Sword Co., Chicopee, Mass.

POLISHING COMPOSITION (See Buffing and Polishing Compositions.)

POLISHING DUST COLLECTING OUTFITS
Small
Leiman Bros., New York.

POLISHING EQUIPMENT AND SUPPLIES (See also Kinds Wanted.)

POLISHING FELTS
American Felt Co., Boston, Mass.
Eastern Felt Co., Winchester, Mass.

POLISHING HOODS (See Dust Collectors and Ventilating Systems; Hoods.)

POLISHING LATHES AND HEADS
Bennett-O'Connell Co., Chicago, Ill.
Connecticut Dynamo & Motor Co., Irvington, N. J.
Crown Rheostat & Supply Co., Chicago, Ill.
Eager Electric Co., Watertown, N. Y.
Excelsior Tool & Machine Co., E. St. Louis, Ill.
Hanson & Van Winkle Co., Newark, N. J.
Munning, A. P., & Co., New York-Chicago.
Pryibil, P., Machine Co., New York.

POLISHING MACHINES (Also see Polishing Lathes and Heads.)
Automatic
Acme Mfg. Co., Detroit, Mich.
Excelsior Tool & Machine Co., E. St. Louis, Ill.

POLISHING MEAL FOR DRY BARREL TUMBLING
Peckham Mfg Co., Newark, N. J.

POLISHING AND BURNISHING; JOB AND CONTRACT (See also Electro Plating.)
Cohan-Epner Co., New York.
Sievering, Philip, New York.

POLISHING WHEELS (See Buffing and Polishing Wheels).

POLISHING AND GRINDING ENGINEERS (See Engineers.)

POLYSULPHIDE
Roessler & Hasslacher Chemical Co., New York.

POTASH
Real
International Chemical Co., Philadelphia, Pa.
First Sorts
International Chemical Co., Philadelphia, Pa.

POWDERED METALS
Aluminum
Kemp, W. H., Co., New York.
Bronze
Du Pont, E. I., de Nemours & Co., Wilmington, Del.

POWDERED COAL BURNERS (See Burners.)

POWER PRESSES
Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.

PRESSES (Also see Scrap Baling Machine.)
Bench and Foot
Baird Machine Co., Bridgeport, Conn.
Bliss, E. W., & Co., Brooklyn, N. Y.
Shuster, F. B., Co., New Haven, Conn.
Drop
Miner & Peck Mfg. Co., Derby, Conn.
Hydraulic
Watson-Stillman Co., New York.
Power, all Types
Baird Machine Co., Bridgeport, Conn.
Bliss, E. W., Co., Brooklyn, N. Y.
Garrison, A., Foundry Co., Pittsburgh, Pa.

PRESSURE BLOWERS (See Blowers and Blow-Piping.)

PULLEYS, MAGNETIC
Dings Magnetic Separator Co., Milwaukee, Wis.

PUMICE STONE
Picotte, P. E., Co., Inc., New York.

RARE METALS (See Metal Dealers.)

RECLAIMING MACHINERY, METAL (Also see Concentrating Tables; Crushers and Pulverizers; Magnetic Separators.)
Eastern Machinery Co., New Haven, Conn.
Paxson, J. W., Co., Philadelphia, Pa.
Standard Equipment Co., New Haven, Conn.

RECORDING THERMOMETERS (See Thermometers.)

REFINERS AND SMELTERS (See Smelters and Refiners.)

RESPIRATORS
American-La France Fire Engine Co., Inc., Elmira, N. Y.

RETORTS, GRAPHITE
Dixon, Joseph, Crucible Co., Jersey City, N. J.
Gautier, J. H., & Co., Jersey City, N. J.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Ross-Tacony Crucible Co., Tacony, Philadelphia, Pa.

RHEOSTATS (See also Electrical Apparatus and Equipment.)
Connecticut Dynamo & Motor Co., Irvington, N. J.
Crown Rheostat & Supply Co., Chicago, Ill.

RIDDLES (See Foundry Riddles.)

RIVET MAKING MACHINERY
Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.

RIVETING MACHINES
Shuster, F. B., Co., New Haven, Conn.

RIVETS, NAILS & TACKS, ALL METALS
Hassall, John, Inc., Brooklyn, N. Y.

RODS AND BARS (Also see Brass Mill Products.)
Aluminum
British Aluminum Co., Ltd., New York-Toronto, Can.
Electric Smelting & Aluminum Co., Lockport, N. Y.
Brass, Bronze and Copper
American Brass Co., Waterbury, Conn.
Chase Metal Works, Waterbury, Conn.
Rome Brass and Copper Co., Rome, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
Standard Underground Cable Co., Pittsburgh, Pa.

ROLLING MILL MACHINERY (See also Draw Benches; Hydraulic Machinery; Presses; Rolls; Shears; Slitters.)
Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.

ROLLS
Chilled and Sand Iron
Garrison, A., Foundry Co., Pittsburgh, Pa.
Jewelers'
Garrison, A., Foundry Co., Pittsburgh, Pa.
Leiman Bros., New York.

ROLLS AND COILS (See Sheets and Strip Metal.)
Brass, Copper and Bronze
Rome Brass and Copper Co., Rome, N. Y.

ROUGE (Also see Buffing and Polishing Compositions.)
Williamsville Buff Mfg. Co., Danielson, Conn.

RUST PREVENTATIVES
International Chemical Co., Philadelphia, Pa.
Oakley Chemical Co., New York.

SAFETY DEVICES AND APPAREL
Respirators
American-La France Fire Engine Co., Inc., Elmira, N. Y.

SAND
Molding
Paxson, J. W., Co., Philadelphia, Pa.
For Sand Blasting
Standard Equipment Co., New Haven, Conn.

BUYERS' GUIDE: ADVERTISERS' PRODUCTS

SAND BLASTS

Accessories and Supplies
New Haven Sand Blast Co., New Haven, Conn.
Standard Equipment Company, New Haven, Conn.

Barrel
Hoevel Mfg. Corporation, Jersey City, N. J.
New Haven Sand Blast Co., New Haven, Conn.
Pangborn Corporation, Hagerstown, Md.
Paxson, J. W., Co., Philadelphia, Pa.
Standard Equipment Company, New Haven, Conn.
U. S. Sand Blast Mfg. Co., New York.

Cabinet
Astle, H. J., & Co., Providence, R. I.
Leiman Bros., New York.
Paxson, J. W., Co., Philadelphia, Pa.

Car
Pangborn Corporation, Hagerstown, Md.

Revolving Table
Hoevel Mfg. Corporation, Jersey City, N. J.
Pangborn Corporation, Hagerstown, Md.

Sand Blast Systems
New Haven Sand Blast Co., New Haven, Conn.
Pangborn Corporation, Hagerstown, Md.
Standard Equipment Company, New Haven, Conn.
U. S. Sand Blast Mfg. Co., New York.

SAND BLASTS AND EQUIPMENT
Pangborn Corporation, Hagerstown, Md.

SAND DRYERS
Pangborn Corporation, Hagerstown, Md.

SAND MIXERS
Wadsworth Core Machine & Equipment Co., Akron, Ohio.

SAND SIFTERS
Pangborn Corporation, Hagerstown, Md.
Wadsworth Core Machine & Equipment Co., Akron, Ohio.

SASH, STEEL
Lupton's, David, Sons Co., Philadelphia, Pa.

SAWDUST

Hard & Soft
National Sawdust Co., Brooklyn, N. Y.

Dustless for Drying Out Metal Goods
National Sawdust Co., Brooklyn, N. Y.

SAWDUST DRYING-OUT BOXES (Also see Drying-Out Machines.)
Smith-Richardson Co., Attleboro, Mass.

SAWDUSTLESS METAL DRYERS
Tolhurst Machine Co., Troy, N. Y.

SAWS, CIRCULAR SAWS, BAND SAWS FOR WOOD AND METAL
Pryibil, P., Machine Co., New York.

SCRAP METAL DEALERS (See Drosses, Residues, Etc., Buyers of; Turnings, Chips, Etc., Buyers of; Metal Dealers.)

SCREW MACHINE PRODUCTS (Also see Machined Products.)
Economy Machine Products Co., Chicago, Ill.

SEPARATORS, MAGNETIC (See also Magnetic Separators.)
Dings Magnetic Separator Co., Milwaukee, Wis.

SHEARS (Also see Slitters.)

Power
Bliss, E. W., Co., Brooklyn, N. Y.

SHEEPSKIN LEATHER
Yorkville Mfg. Co., Brooklyn, N. Y.

SHEEPSKIN POLISHING WHEELS
Yorkville Mfg. Co., Brooklyn, N. Y.

SHEET METAL PIPING FOR ALL PURPOSES
No-Dust Drying Machine Co., Providence, R. I.

SHEETS (Also see Brass Mill Products; Strip Metal.)

Aluminum
British Aluminum Co., Ltd., New York-Toronto, Canada.
Electric Smelting & Aluminum Co., Lockport, N. Y.
Kemp, W. H., Co., New York.

Brass, Copper and Bronze
Rome Brass and Copper Co., Rome, N. Y.

SHEETS (Continued)

Brass, Copper and Nickel Silver
American Brass Co., Waterbury, Conn.
Bristol Brass Co., Bristol, Conn.
Chase Metal Works, Waterbury, Conn.
Dallas Brass & Copper Co., Chicago, Ill.
Manhattan Brass Co., New York.
Metal Purchasing Co., New York.
New England Brass Co., Taunton, Mass.
Scovill Mfg. Co., Waterbury, Conn.
Western Cartridge Co., East Alton, Ill.

Bronze
New England Brass Co., Taunton, Mass.

Copper
Baltimore Copper Smelting & Rolling Co., Baltimore, Md.
Hussey, C. G., & Co., Pittsburgh, Pa.
National Brass & Copper Co., Lisbon, Ohio.

Muntz's Metal
Taunton-New Bedford Copper Co., Taunton, Mass.

Nickel
Driver-Harris Co., Harrison, N. J.

Nickel-Silver
Dueber Watch Case Mfg. Co., Canton, Ohio.
New England Brass Co., Taunton, Mass.
Seymour Mfg. Co., Seymour, Conn.

Plated and Polished
American Nickeloid Co., Peru, Ill.
Apollo Metal Works, La Salle, Ill.
National Sheet Metal Co., Peru, Ill.

Platinum
Roessler & Hasslacher Chemical Co., New York.

Silver, Sterling
Handy & Harmon, New York.
Jackson, John J., Co., Newark, N. J.

Zinc
Illinois Zinc Co., Peru, Ill.
Matthiesen & Hegeler Zinc Co., La Salle, Ill.
New Jersey Zinc Co., New York.
Platt Bros. Co., Waterbury, Conn.

SHELVING, STEEL
Lupton's, David, Sons Co., Philadelphia, Pa.

SIGNS, METAL SAFETY
American-La France Fire Engine Co., Inc., Elmira, N. Y.

SILICON-COPPER
Electric Smelting & Aluminum Co., Lockport, N. Y.

Boronic
American Boron Products Co., Reading, Pa.

SILVER (See Smelters and Refiners; Anodes; Bars; Castings; Ingots; Metal Dealers; Sheets; Solder; Etc.)

SILVER, BORONIC
American Boron Products Co., Reading, Pa.

SILVER CYANIDE
Middlesex Aniline Co., Lincoln N. J.
Roessler & Hasslacher Chemical Co., New York.

SILVERSMITHS' BRUSHES (See Brushes.)

SLAB ZINC
Hegeler Zinc Co., Danville, Ill.
Illinois Zinc Co., Peru, Ill.
Matthiesen & Hegeler Zinc Co., La Salle, Ill.
New Jersey Zinc Co., New York.

SLAG CRUSHERS (See Crushers and Pulverizers.)

SLITTERS, SHEET METAL (Also see Shears.)
Sundh Engineering & Machine Co., Philadelphia, Pa.

SMELTERS AND REFINERS (Also see ingots.)

Copper-Bearing Material
Capper, Pass & Son, Ltd., Bristol, England.
Great Western Smelting & Refining Co., St. Louis, Mo.
Whipple & Choate Company, Bridgeport, Conn.

Gold
Handy & Harman, New York.

SMELTERS AND REFINERS (Continued)

Platinum
Roessler & Hasslacher Chemical Co., New York.

Silver
Goldsmith Bros. Smelting & Refining Co., Chicago, Ill.
Handy & Harman, New York.

White Metals
Great Western Smelting & Refining Co., St. Louis, Mo.
Michigan Smelting & Refining Co., Detroit, Mich.

Zinc
New Jersey Zinc Co., New York.

SOAP AND SOAP CHIPS
International Chemical Co., Philadelphia, Pa.
Oakley Chemical Co., New York.

SODA, MODIFIED
Solvay Process Co., Syracuse, N. Y.

SODA ASH
Roessler & Hasslacher Chemical Co., New York.
Solvay Process Co., Syracuse, N. Y.

SODIUM CYANIDE
Cooper, Chas., & Co., New York.
Roessler & Hasslacher Chemical Co., New York.

SOLDER

Tinners
Michigan Smelting & Refining Co., Detroit, Mich.

SOLDER MOLDS (See Molds.)

SOLDERING FLUX (See Fluxes.)

SOLDERING, ZINC
New Jersey Zinc Co., New York.

SOLUTION FILTER SYSTEM
Belkes Perfect Tank Filter, Chicago, Ill.

SOLVENTS
Du Pont, E. I., de Nemours & Co., Wilmington, Del.
Egyptian Lacquer Mfg. Co., New York.
Izen Company, Inc., New York.
Zeller Lacquer Mfg. Co., New York.

SPECIALTIES, METAL (See Wire Specialties; Wire Shapers and Forms; Metal Goods Made to Order.)

SPELTER (See Slab Zinc; also see Ingots.)

SPELTER SOLDER (See Solder Brazing.)

SPINNING CHUCKS (See Chucks.)

SPINNING LATHES (See Lathes.)

SPOUTS, MAGNETIC
Dings Magnetic Separator Co., Milwaukee, Wis.

SPRAYERS

Foundry
De Vilbiss Mfg. Co., Toledo, Ohio.

Lacquer, Enamel, Japan, Paint
Eclipse Air Brush Co., Newark, N. J.
Economy Machine Products Co., Chicago, Ill.
Eureka Pneumatic Spray Co., New York.
Holton, B., Co., Los Angeles, Cal.
Universal Sprayer Co., New York.

SPRAYING ACCESSORIES, HOODS, TABLES, ETC.
De Vilbiss Mfg. Co., Toledo, Ohio.
Eclipse Air Brush Co., Newark, N. J.
Holton, B., Co., Los Angeles, Cal.
Universal Sprayer Co., New York.

SPRAYING EQUIPMENT, PORTABLE
De Vilbiss Mfg. Co., Toledo, Ohio.
Universal Sprayer Co., New York.

SPRUE CUTTERS (See also Saws.)
Shuster, F. B., Co., New Haven, Conn.
Turner Machine Co., Philadelphia, Pa.

STAMPING AND DRAWING, JOB AND CONTRACT (Also see Metal Goods Made to Order.)
Bridgeport Brass Co., Bridgeport, Conn.
Globe Machine & Stamping Co., Cleveland, Ohio.
Kenworthy, Charles F., Inc., Waterbury, Conn.
Western Cartridge Co., East Alton, Ill.

STEEL BALLS FOR BURNISHING BARRELS
Abbott Ball Co., Hartford, Conn.
Baird Machine Co., Bridgeport, Conn.
Crown Rheostat & Supply Co., Chicago, Ill.
Globe Machine & Stamping Co., Cleveland, Ohio.
Henderson Bros. Co., Waterbury, Conn.
No-Dust Drying Machine Co., Providence, R. I.
Smith-Richardson Co., Attleboro, Mass.

BUYERS' GUIDE: ADVERTISERS' PRODUCTS

STEEL, BORONIC
American Boron Products Co., Reading, Pa.

STEEL WOOL
Picotte, P. E., Co., Inc., New York.

STIRRERS (See Graphite Products.)

STONEWARE, ACID-PROOF (See Acid Pumps; Dipping Baskets.)

STRAIGHTENING, CUTTING AND FORMING MACHINERY (See Cutting, Straightening and Forming Machinery.)

STRIP METAL IN COILS AND ROLLS (Also see Brass Mill Products.)

Brass, Copper and Bronze
Rome Brass and Copper Co., Rome, N. Y.

Brass, Copper and Nickel Silver
American Brass Co., Waterbury, Conn.
New England Brass Co., Taunton, Mass.
Scovill Mfg. Co., Waterbury, Conn.

Copper
National Brass & Copper Co., Lisbon, Ohio.
Rome Brass and Copper Co., Rome, N. Y.

Zinc
New Jersey Zinc Co., New York.
Platt Bros. Co., Waterbury, Conn.

SULPHATE OF ALUMINUM
Roessler & Hasslacher Chemical Co., New York.

SULPHITE OF COPPER
Wiarda, John C., & Co., Brooklyn, N. Y.

SULPHITE OF POTASSIUM
Buchanan, C. G., Chemical Co., Cincinnati, Ohio.

SULPHOCYANIDE OF SODA
Roessler & Hasslacher Chemical Co., New York.

SWEEP SMELTERS (See Smelters and Refiners.)

SWITCHBOARDS (See also Electrical Apparatus and Equipment.)

TANK FILTER
Belkes Perfect Tank Filter, Chicago, Ill.

TANKS

Wood
Atlantic Tank & Barrel Corp., Hoboken, N. J.
Corcoran, A. J., & Co., Jersey City, N. J.
Hanson & Van Winkle Co., Newark, N. J.
Kalamazoo Tank & Silo Co., Kalamazoo, Mich.
Munning, A. P., & Co., New York-Chicago.
Passaic Carpenter & Millwright Shop, Passaic, N. J.
Stearns, A. T., Lumber Co., Boston, Mass.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.

TESTING APPARATUS (See Calipers, Indicating; Pyrometers; Scleroscopes, Thermometers.)

TESTING LABORATORIES (See also Assayers and Chemists.)

Chemical
Norton Laboratories, New York.
Pitkin, Lucius, Inc., New York.

THREAD ROLLING MACHINES
Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.

TIN; PIG, BAR AND BLOCK (See also Ingots, Tin.)

TINNING (See Electro-Plating, Hot Galvanizing and Tinning.)

TINNING FURNACES (See Galvanizing and Tinning Furnaces.)

TINNING FLUXES (See Fluxes.)

TOOL HARDENING FURNACES (See Heat Treating Furnaces.)

TRIPOLI, LUMP AND GROUND
American Tripoli Co., Seneca, Mo.

TROLLEYS (See Overhead Trolley Systems.)

TUBES (Also see Brass Mill Products.)

Brass, Bronze and Copper
American Brass Co., Waterbury, Conn.
Chase Metal Works, Waterbury, Conn.
Rome Brass and Copper Co., Rome, N. Y.
Rome Hollow Wire & Tube Co., Rome, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
Standard Underground Cable Co., Pittsburgh, Pa.
Wheeler Condenser & Engineering Co., Carteret, N. J.

Brass and Copper, Small Sizes
Rome Hollow Wire & Tube Co., Rome, N. Y.

Brazed and Seamless
Rome Brass and Copper Co., Rome, N. Y.

Condenser
Wheeler Condenser & Engineering Co., Carteret, N. J.

TUMBLING BARRELS (Also see Burnishing and Polishing Barrels; Plating Barrels.)

All Kinds
Baird Machine Co., Bridgeport, Conn.
Globe Machine & Stamping Co., Cleveland, Ohio.

Foundry
Baird Machine Co., Bridgeport, Conn.
Globe Machine & Stamping Co., Cleveland, Ohio.
Henderson Bros. Co., Waterbury, Conn.
Wadsworth Core Machine & Equipment Co., Akron, Ohio.

Japanning
Baird Machine Co., Bridgeport, Conn.
Globe Machine & Stamping Co., Cleveland, Ohio.

Lacquering
Baird Machine Co., Bridgeport, Conn.
Globe Machine & Stamping Co., Cleveland, Ohio.

Oblique
Baird Machine Co., Bridgeport, Conn.
Globe Machine & Stamping Co., Cleveland, Ohio.

TURNINGS, CHIPS, ETC., BUYERS OF (Also see Drosses, Residues, Etc., Buyers of; Metal Dealers.)

TURPENTINE
Apothecaries Hall Co., Waterbury, Conn.

TYPE METAL (See Ingots)

VACUUM PUMPS, ROTARY
Leiman Bros., New York.

VARNISHES FOR ALL PURPOSES
Du Pont, E. I., de Nemours & Co., Wilmington, Del.
Hilo Varnish Corporation, Brooklyn, N. Y.

VENTILATING SYSTEMS (See Blowers and Blow Piping; Dust Collectors and Ventilating Systems; Exhaust Fans and Heads.)

VIBRATORS
Campbell-Hausfeld Co., Harrison, Ohio.

VIENNA LIME COMPOSITIONS (See Buffing and Polishing Compositions.)

VOLTMETERS (Also see Electrical Apparatus and Equipment.)
Connecticut Dynamo & Motor Co., Irvington, N. J.

WALRUS HIDES
Yorkville Mfg. Co., Brooklyn, N. Y.

WASHING MACHINE, METAL PARTS
No-Dust Drying Machine Co., Providence, R. I.

WASTE CLEANER AND OIL RECLAIMER
International Chemical Co., Philadelphia, Pa.
Oakley Chemical Co., New York.

WEIGHERS AND SAMPLERS
Pitkin, Lucius, Inc., New York.

WHALE OIL SOAP (Also see Cleaning Compounds; Fig Cleansers.)
International Chemical Co., Philadelphia, Pa.

WHITE METALS (See Smelters and Refiners; Babbitt Metal; Ingots; Etc.)

WIPERS
Bennett-O'Connell Company, Chicago, Ill.

WIRE

Aluminum
British Aluminum Co., Ltd., New York-Toronto, Canada.

Brass, Copper and Nickel-Silver
American Brass Co., Waterbury, Conn.
Rome Wire Co., Rome, N. Y.
Scovill Mfg. Co., Waterbury, Conn.

Nichrome
Driver-Harris Co., Harrison, N. J.

WIRE CLOTH
Smith, John P., & Co., New Haven, Conn.

WIRE DRAWING MACHINES
Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.

WIRE FORMING MACHINERY (See also Cutting, Straightening and Forming Machinery.)
Baird Machine Co., Bridgeport, Conn.

WIRE MILL PRODUCTS (Also see Brass Mill Products; Wire.)
Galena Mfg. Co., Galena, Ill.
Rome Wire Co., Rome, N. Y.

WIRE STRAIGHTENING AND CUTTING MACHINERY (See Cutting, Straightening and Forming Machinery.)

WIRE WHEEL BRUSHES (See Brushes.)

WIRING DEVICES (See Electrical Apparatus and Equipment.)

WOOD ENAMELS (See Enamels.)

WOOD LACQUERS (See Lacquers.)

WOODFILLERS, PASTE
Du Pont, E. I., de Nemours & Co., Wilmington, Del.
Hilo Varnish Corporation, Brooklyn, N. Y.

YELLOW BRASS (See Sheets, Munts's Metal.)

ZINC (See Slab Zinc; Smelters and Refiners; Anodes; Sheets; Strip Metal; Etc.)

ZINC CYANIDE
Middlesex Aniline Co., Lincoln, N. J.
Roessler & Hasslacher Chemical Co., New York.

ZINC DUST
New Jersey Zinc Co., New York.

ZINC PLATING (See Electro-Galvanizing.)

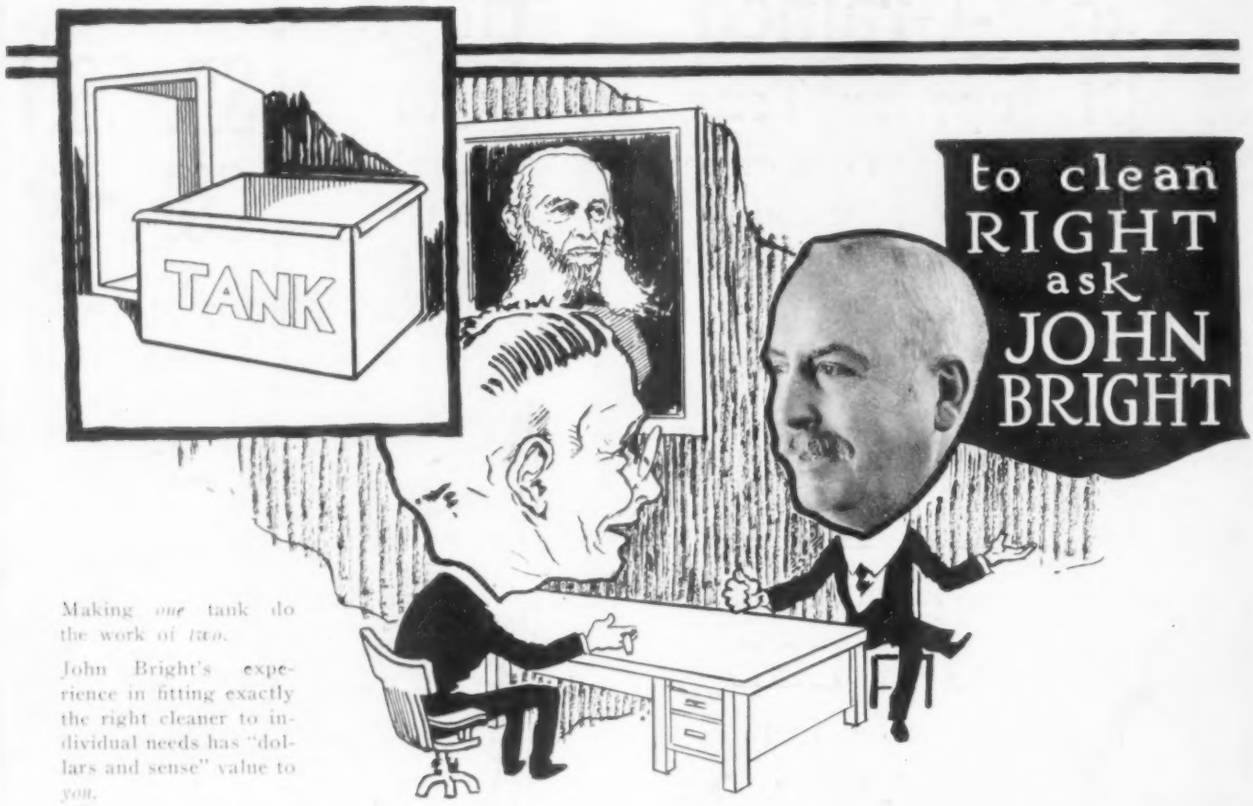
ZINC PRODUCTS
New Jersey Zinc Co., New York.

ZINC, ROLLED (Also see Sheets, Zinc.)
New Jersey Zinc Co., New York.

ZINC SALTS, COMMERCIAL
U. S. Electro Galvanizing Co., Brooklyn, N. Y.

ALPHABETICAL INDEX OF ADVERTISEMENTS

FOR INDEX TO ADVERTISEMENTS, SEE PAGE 75



Making *one* tank do the work of *two*.

John Bright's experience in fitting exactly the right cleaner to individual needs has "dollars and sense" value to *you*.

Strange

—how some manufacturers stick to the old cleaning methods their grand-dads used. Every once in a while I run into a concern like that. They tell me they are satisfied with their old time cleaners. Yet they have ditched the stage coach in favor of the railroads, and reach for the telephone instead of sending a messenger.

When I let loose a few remarks about how things have changed since grandpa's day and that many new things have been perfected even since the War, they begin to see what I am driving at. And when I show them how to clean scientifically and how to make one tank do the work of two, they just naturally sit up and take notice.

Everyone is satisfied until he finds something better. But when you show a man how to spend but ***one*** dollar where he used to spend ***two***—in time and materials—he is your friend. That's why my customers are my friends for life!

Let me show you how to reduce your cleaning costs and increase your production. My services won't cost you a cent. Just write me in detail about your cleaning conditions and what you are cleaning. I'll prescribe the correct one of our forty compounds for your particular need—and I'll ***guarantee*** it to do all I claim. If it does not—don't pay for it.

Internationally yours,
John Bright

International Products
I.C.C.
International Chemical Co.

INTERNATIONAL CHEMICAL CO. Philadelphia, Pa.